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ON THE DECAY OF WOOD.

Inquiry into the causes of the Decay of Wood, and the Means of preventing it, by DR. PARRY.

(From the Eleventh Volume of the "Letters and Papers," selected from the Correspondence of the Bath and West of England Society for the encouragement of Arts, Agriculture, Manufactures, and Commerce, p. 226.)

1. THE power of wood in different forms to supply luxury, to promote science, and to guard and prolong human life, has made the means of preserving it from decay highly interesting to mankind. With this view various premiums have been offered by this and other economical societies. The object of the following discussion is to suggest the best means of prevention, chiefly by inquiring into the nature and sources of the evil against which it is intended to guard.

Wood, when killed by being separated from its root, is subject to gradual destruction from two causes---rotting, and the depredations of insects.

Of the rot there are two supposed kinds, as they affect wood, first, in the open air, or secondly, under cover.

The first is that which in the terms of our premium, Class VII. No. 3, is said to occur to "barn and other outside-doors, weather-boarding, gates, stiles, and implements of husbandry." To

which, if there were any need of this minute specification, might have been added, posts, rails, paling, water-shoots, and various other objects.

The second is well known under the name of the dry-rot, the cause and prevention of which are the subjects of a premium by the Society of Arts in London.

Animal and vegetable substances possess certain common properties and movements, which constitute what is called life. When that state ceases, and these properties and motions no longer exist, the bodies become subject to the chemical and mechanical laws of all other matter.

When perfectly dry, and in certain degrees of temperature, both seem to be scarcely capable of spontaneous decay. On this principle vast quantities of salmon are annually conveyed in a frozen state to London from the north of England and Scotland; and the inhabitants of the still more northern regions constantly preserve there food by freezing, unchanged through the longest winters. The gelatinous and other soluble parts of animal substances, when extracted by boiling and kept in a soft moist state, very readily putrefy. But if the same matter be dried by a gentle heat, and secluded from moisture and air by being kept in bottles or metallic cases, it will remain very long without decay. This is the theory of that well-known and useful substance, portable soup. In the burning climate of Africa, when it is intended to preserve a dead animal for food, all that is necessary is to cut the muscular parts into thin strips, from which, in a few hours, the heat of the sun exhales all moisture, reducing them to a substance like leather or horn, which proves to be unsusceptible of future decay from putrefaction. So also entire human bodies, buried in the arid sands of those countries, have often been found converted by exhalation and absorption of their natural moisture into a dry hard sort of mummy, incapable of any further change from the agency of those causes, to which, in such situations, they are exposed.

Similar causes produce the same effects on wood. Even under less rigid circumstances of this kind, as in the roofs and other timber of large buildings, it continues for an astonishing length of

time unchanged; witness the timber of that noble edifice Westminster-hall, built by Richard II. in 1397; and the more extraordinary instance quoted by Dr. Darwin, in his ingenious work the Phytologia, of the gates of the old St. Peter's church in Rome, which were said to have continued without rotting from the time of the emperor Constantine to that of Pope Eugene IV. a period of eleven hundred years. On the other hand, wood will remain for ages with little change, when continually immersed in water, or even when deeply buried in the earth; as in the piles and buttresses of bridges, and in various morasses. These latter facts seem to show, that if the access of atmospherical air is not necessary to the decay of wood, it is, at least, highly conducive to it.

In posts fixed in the ground and exposed to the weather, we constantly find that part soonest decay, which is just above or within the ground. So also where there is an accidental hole in an exposed surface, or any artificial cavity, as in a mortise and tenon, or the part where pales nearly touch the rails on which they are nailed, there the wood universally begins first to moulder away. The same thing happens with regard to horizontal rails themselves, which, when made of the same materials, rot much sooner than the pales which they support. These facts are very easily explained. They clearly show, that the great cause of decay is the constant action of water aided by air, which most affects those points where it is most retained, but has less operation, where, as in the perpendicular pales, it chiefly runs off by its own gravity, so that the little which remains is easily and quickly abstracted by the co-operating power of the sun and wind.

The change which I am describing is the consequence of putrefactive fermentation; a chemical operation, in which the component parts of the wood form new combinations among themselves, and with the water which is essential to the process. The precise nature of those new compounds has not been ascertained; but, so far as they are known, consist of certain gases, or species of air, which fly off, and leave behind a powder, consisting chiefly

of carbon or charcoal, and the earth which entered into the original composition of the wood.

Besides this chemical change depending on water, that substance tends to destroy wood exposed to the open air by a mechanical operation. Every farmer is acquainted with the power of winter in mouldering down the earth of his fallows. It is equally well known that porous freestone splits and shivers during severe winters. These effects are produced by frost, which, acting on the water in the pores or interstices of these substances, expands it by conversion into ice, and thus bursts the minute cells in which it was contained. There can be no doubt that a similar operation takes place to a certain extent in exposed wood, and thus in some degree promotes its destruction.

It appears, then, that the contact of water and air are the chief causes of the decay of wood. If, therefore, any means can be devised, by which the access of moisture and air can be prevented, the wood is so far secure against decay. This principle may be illustrated, by supposing a cylinder of dry wood to be placed in a glass tube or case, which it exactly fills, and the two ends of which are, as it is called, hermetically sealed, that is, entirely closed, by uniting the melted sides of each end of the tube. Who will doubt that such a piece of wood might remain in the open air a thousand years unchanged? Or let us take a still more apposite illustration of this fact; that of amber, a native bitumen, or resin, in which a variety of small flies, filaments of vegetables, and others of the most fragile substances, are seen imbedded, having been preserved from decay much longer probably than a thousand years, and with no apparent tendency to change for ten times that period. Let us see then if we cannot, by the exclusion of moisture and air, find means of virtually placing our timber in a case of glass or amber.

With this view, various expedients have been employed, of which the most common is covering the surface with paint; which is oil mixed with some substance capable of giving it the colour which we desire. It is well known that several of the oils, as those of linseed, hempseed, &c. become dry when thinly spread

on any hard substance. The drying quality is much assisted by their being previously boiled with certain metallic oxyds, more especially that of lead litharge. The crust so formed is with difficulty penetrated by moisture or air. For this purpose drying oil is spread on silk or linen, in the manufacture of umbrellas; and will tolerably well succeed in confining hydrogen gas, or inflammable air, in the construction of air-balloons. Hence we see the mode in which the application of paint on wood serves to defend it against the causes of destruction.

When paint is employed within doors, it is customary to add to the oil, besides the colouring matter, some essential oil of turpentine, which not only makes it dry more readily, but, by giving it greater tenuity causes it to flow more freely from the brush, and therefore to go farther in the work. For the same purposes I observe it forms a part of the paint used on wood and iron work in the open air, but, as it appears to me, most improperly; for I have remarked, that on rubbing wood painted white, and long exposed to the weather, the white-lead has come off in a dry powder like whiting; as if the vehicle which glued it to the wood had been decomposed and lost, leaving only the pigment behind: and I have been much inclined to suspect that this has arisen from the oil having been too much *pened*, as the workmen call it, or having its thickness and tenacity too much diminished by a superabundance of the oil of turpentine. In this state it may, in various ways, be more readily acted on by water and air. We know that the properties of what are called unctuous or fat oils are much changed by the admixture of the volatile or essential oils. On this principle we succeed in getting grease out of woolen cloths by oil of turpentine; but whether the same change is produced on the drying oils, I have not learned.

It appears then, that these drying oils, either by themselves, or boiled with metallic oxyds, will form a varnish on wood; but it may be questioned how far the colouring matters, with which they are usually mixed, contribute to increase there preservative power. I do not, however, deny that they may be serviceable in this and other views. They might be supposed to enable the

oil to lay firmer hold, as it were, on the wood; and they may serve to increase the thickness of the defensive covering. The first of these points is of some importance; for we observe that the paint on street-doors, which is become thick by frequent incrustation, is apt, from the strong influence of the summer's sun, to separate from the polished wood beneath, and rise in large blisters; probably in consequence of a greater expansion in the crust itself than in the subjacent wood. Here, therefore, the colouring matter of the paint fails to produce the desired effect; and as to the second end, or that of increasing thickness of the covering, that may, probably, be much more effectually accomplished than by the mere addition of pigments, some of which are capable of chemical decomposition, and all are costly. This purpose an ingenious artist has of late attempted to answer, by recommending an admixture of road-dust: and for that and other means of reducing the price of paints, has obtained a premium from the London Society of Arts. However just the general principle in this case may be, the application is somewhat unphilosophical; unless it shall be found, which will scarcely be admitted, that dust of every chemical and mechanical quality will equally or sufficiently answer the intended purpose.

Some material of this kind, selected with greater precision, may however undoubtedly be useful; and none I think promises more fairely than siliceous or flinty sand, which, so far as we know, is absolutely indestructible, and which may be easily procured from the sea-shore, and from the currents of the clear rivers and roads in Berkshire and other counties abounding with siliceous stones. Sand from the sea must first be cleared from all saline impregnations by washing in several waters, and any sand may be obtained of the fineness desired, by mixing it with water in a tub, and after having stirred the whole well together, pouring out, in a longer or shorter time, the muddy water, from which the sand will settle by its own gravity, in a state fit for use when dried."

More than 30 years ago this subject presented itself to my mind, on seeing some water-shoots which had been pitched and

painted in the common way, taken down in a state of complete rottenness. I had read that charcoal buried in the moist earth, had come down to us perfectly sound from the times of the Romans; and that posts long withstood the same moisture, if the part intended to be put into the ground was charred all round to a certain depth. Impressed with these facts, I determined to try an artifical coat of charcoal; and when new water-shoots were constructed, I strongly and carefully rubbed them with a coat of drying oil, which I immediately dregged all over with a thick layer of a charcoal finely powdered, and contained in a muslin bag. After two or three days, when the oil was thoroughly dried, and firmly retained the greatest part of the charcoal, I brushed off what was loose, and over that which adhered, I applied a coat of common lead-coloured paint, and a few days after, a second. The whole became a firm and solid crust; after which the shoots were put in their places, and being examined many years afterwards, appeared perfectly sound. Any other colour would probably have succeeded equally well with that which I employed. I do not think that lampblack, which is a pure species of charcoal, would have answered the purpose of forming a thick defensive covering so well as the grosser charcoal which I used. But whatever sort of charcoal is employed, it ought either to be fresh made, or heated again in close vessels, so as to expel the water which it greedily attracts from the air.

To all compositions formed from drying vegetable oils there is this objection: that however well they may answer the end proposed, they are too dear, for that great consumption which is usually required for outside work. For this and other reasons, various other substances have been employed for the same purpose.

Of these the most common is pitch, which is well known to be resinous matter melted by heat out of the pine tribe of trees in form of tar, and afterwards hardened by evaporation. It is applied hot, and when cold, makes a moderately hard varnish. It does not however appear, in fact, to answer the purpose so well as might have been expected. The sun at first melts it, so

that it runs off in drops, or adheres to every thing which touches it; and the united influence of air and water seems to make it brittle and powdery like rosin. Experience therefore shows it to be of little value. Neither is it probable that its powers would be much improved by admixture with charcoal, sand, or other similar substances. Many members of this Society may recollect its application twenty years ago on the red deal-shingled roofs of part of Bath Market. In this case it was used hot, mixed with Spanish brown, and hardened by sand sifted over it with a sieve; notwithstanding which it seems to have left the wood like the unmixed pitch, and, though frequently renewed, has not prevented the necessity of various repairs within these last five years. The original boards are now every where more or less in a state of decay.

The bituminous substance melted by heat out of coal, and commonly called Coal Tar, has been strongly recommended for this purpose by that ingenious philosopher Lord Dundonald. I have tried it largely and successfully, though perhaps not fairly; for the workman whom I employed, in order to make it work more easily, added to it oil of turpentine, which certainly diminished its durability by rendering it more miscible with water. I am however inclined to believe that no substance of this kind, used by itself, will become sufficiently dry and hard to resist the influence of the weather.

As animal oils are considerably cheaper than those expressed from vegetables, attempts have been made to communicate to them a drying quality. This has been effected by dissolving in them while hot various substances capable of being melted, in such a portion that the whole mass would become dry and hard when cold. Bees' wax, rosin and brimstone, are found to have this property. Some of them, when united with drying oil, have long been employed for making boots and shoes water-proof, or impervious to moisture.* But they will also succeed when mixed

* For this purpose there is the following receipt by Mr. Barker, in Sir John Hawkins's edition of that entertaining work, Isaac Walton's Complete Angler; 4th edition, page 223. "Take a point of linseed oil, with half a pound

with train oil, which is obtained from the blubber of the whale. In the second volume of the Memoirs of this Society, printed in the year 1783, there is the following receipt: "Melt twelve ounces of rosin in an iron pot or kettle; add three gallons of train oil and three or four rolls of brimstone; and when the rosin and brimstone are melted and become thin, add as much Spanish brown, or red or yellow ochre, or any colour you want, first ground fine with some of the oil, as will give the whole as deep a shade as you like. Then lay it on with a brush as hot and thin as you can. Some days after the first coat is dried, give it a second. It will preserve plank for ages, and keep the weather from driving through brick-work." Page 114.

This composition I tried about eighteen years ago on some elm paling, substituting for the colouring matter one or two coats of common white paint, for the sake of the appearance. This paling appears to me to be in every part of it which was so covered, as sound as when it was first put up.

As compositions of the resinous kind are apt to crack and become powdery, like the varnish of carriages, by exposure to weather, it is not improbable that this effect may be in some measure counteracted by the mixture of a small portion of bees' wax. Such a compound I have used, but in the quantity of 8 ounces to the gallon, found it too slow in drying, and capable of being easily scraped off with the nail. Wax is also at this time very scarce and dear.*

of mutton suet, six or eight ounces of bees' wax, and half a pennyworth of rosin. Boil all these in a pipkin together; so let it cool till it be milk-warm. Then take a little hair-brush, and lay it on your new boots; but it is best that this stuff be laid on before the boot-maker makes the boots; then brush them once over (with it) after they come from him. As for old boots, you must lay it on when your boots be dry."

* For the information of those who may be inclined to make a trial of these compositions, I have inquired the wholesale prices of the different ingredients of Messrs. Cave and Co. Bristol, from whom I learn that they are very fluctuating, train oil being from 2s. 3d. to 3s. 2d. per gallon; rosin from 12 to 21 shillings per cwt.; roll brimstone from 34 to 38 shillings per cwt.; and bees' wax from 3s. 3d. to 3s. 6d. per lb.; the lowest of these prices being about what these articles at present bear.

All the substances contained in these mixtures are capable of perfect incorporation with each other by heat, and when separately exposed, are with great difficulty acted on by water or air in any heat which occurs in our climate. They should be applied hot with a common painter's brush on the wood which is previously very dry, so as to sink deeply into its pores; and though at first they are apparently somewhat greasy when cold, yet after some days they make a firm varnish, which does not come off on rubbing. When it is required to give beauty to the work, colouring matters may either be added to the mixture, or afterwards applied over it in form of common paint. Two coats of the composition should always be given; and in all compound machinery, the separate parts should be so varnished before they are put together; after which it will be prudent to give a third coating to the joints, or to any other part which is peculiarly exposed to the action of moisture, such as water-shoots, flood-gates, the beds of carts, the tops of posts and rails, and all timber which is near or within the ground. Each coat should be dry before the parts are joined, or the last coat applied.

These compositions are equally efficacious in keeping iron from decay by rusting. They might also be very advantageously employed in rendering water-tight the plaster which is used to case the outside of the arches of vaults unsheltered by roofs, provided the mortar were made perfectly dry, and the covering of the arch brought up to an angle, instead of making it follow the form of the arch in an elipse or the segment of a circle.

It is necessary to mention that compositions made of hot oil should, for the sake of security, be heated in metallic or glazed earthen vessels in the open air. For whenever oil is brought to the boiling point, or 600° of Fahrenheit's thermometer, the vapour immediately catches fire, although not in contact with any flame; and though a lower degree of temperature than that of boiling should be used in this process, it is not always practicable either exactly to regulate the heat, or to prevent the overflowing of the materials, in either of which cases, were the melting performed in a house, the most fatal accidents might follow.

The following is the proportion of the above ingredients, and the mode of mixing them, which I should recommend.

Take 12 ounces of rosin, and 8 ounces of roll brimstone, each coarsely powdered, and 3 gallons of train-oil. Heat them slowly, gradually adding 4 ounces of bees' wax, cut in small bits. Frequently stir the liquor, which, as soon as the solid ingredients are dissolved, will be fit for use. What remains unused will become solid on cooling, and may be re-melted on subsequent occasions.

If the addition of charcoal powder or siliceous sand contributes to the durability of drying oil, it may probably have a similar effect on this composition; but whether it may be best to mix them with the ingredients, or apply them afterwards, I cannot from experience tell. In the latter case, the powder should be sifted on, while the first coat of the composition is still hot; and after some days, when that is dry, should have a brush gently passed over it, in order to remove all the particles which do not adhere; after which other coats of the composition may be applied, as before directed.

This is all which occurs to me as to the mode of preserving wood when exposed to the weather.

When wood decays under cover, that condition is usually called the dry-rot. Let us examine the circumstances in which this change takes place.

It affects the interior doors, shelves, laths which subdivide the layers of wine, and all other wood work in certain cellars; beams and rafters which support the roofs of close passages; joists lying on or near the earth; the wainscoting of large rooms little inhabited, in old and especially single houses; and wood in various other situations of a similar kind, which need not be particularized. In some of these cases, while one sample or portion of wood shall suffer the dry-rot, another specimen or portion shall remain unchanged. In other instances, wood of various kinds and qualities has been successively employed, and all has alike suffered. During the stages of change, a crop of mucor or mould, and very frequently of fungi, has sprung from the porous mass; and the decay is always attended with a wide-spreading exhala-

tion, the odour of which cannot well be described, but which is sufficiently known.

What then are the causes of this destruction? Precisely the same as those which I have before described; though their action is differently modified, and less obvious to gross observation. The decay is produced by the putrefactive fermentation of the component parts of the wood, in connexion with moisture, without which, as I have before stated, wood cannot putrefy.

Common air is not only capable of mixing with a considerable quantity of water in form of vapour, but during every state of our atmosphere is always much loaded with it. Water becomes vapour in consequence of being united with a certain proportion of that substance which is called heat. If a sufficiently cold substance comes in contact with vapour, the superabundant heat, which was necessary to its existence in that form, passes into that cold substance, and the vapour is then immediately condensed or changed into water. Thus if in the hottest day in summer, when the vapour in our breath is totally invisible, we breathe on a looking-glass or plate of polished metal, which is colder than our breath, the surface is immediately dimmed; and if we continue to breathe on it, small drops of liquid appear, which gradually become larger and larger, and many of which at length uniting, run down the surface in a stream. The same thing takes place on the outside of a glass of water drawn in summer from a deep well, and of a bottle brought up into a warm room out of a cold cellar; and on the inside of our windows in frosty weather. On the other hand, we could not dim with our breath a plate of metal or glass of 100 degrees of heat, which is greater than that of our breath, and no mist is observable on the inside of our windows during the heat of a summer's day; nor is there any condensation of moisture on the outside of a glass of cold water fresh drawn from the well, or of a bottle out of a cellar, when either is brought into the open frosty air.

These circumstances will explain many appearances, by which, for want of due examination, we are often greatly puzzled. We are frequently mortified by seeing in our houses, especially in the

country, the walls become stained, or the paper separated and hanging down, and often perishing; and as this usually happens on the side or corner which is most exposed to the weather, we conclude that the damp comes through the wall, and tax our faculties to the utmost in order to prevent this penetration. The measures which we employ sometimes succeed. But it often happens that casing and plastering and painting the devoted angle fails; and then, as the last resource, we take off the paper and attach it to canvas at the distance of one or more inches from the wall, and thus, for the present at least, affect the desired purpose. Now in this case it is just as absurd to suppose that the wet comes through the wall, as that it comes through the glass window in a frosty day, or the glass or bottle from the well or cellar. The fact is, that in an exposed house, and more especially on the most exposed corner of a room seldom warmed by fire, the inner surface of the wall, by the continuance of the frost, is become of a very low temperature, like the air within the room itself. So long as this state of equal temperature between the wall and internal air continues, or if the wall is warmer than the air, it is obvious that the vapour which is mixed with that air cannot part with any heat to the wall, and, therefore, will not undergo condensation; just as no dampness appears on our windows during a hot day in summer. But if a thaw comes on, and the air becomes warmer than the wall, which, from its capacity of easily shifting place, it will readily do, then the vapour, which is mixed with it, parts with its superabundant heat to the colder wall, and appears on it in moisture or drops, or pours down it in streams; just as happens to the cold bottle brought into the warm dining-room.

This change is the greater, the more completely the materials of the wall fit it for carrying the heat out of the vapour, or, in philosophical language, the better they conduct heat. Hence a wall painted in oil condenses vapour, or runs with water, sooner than one, which, being unpainted, is more porous; for which reason, in cities, we first perceive dampness and drops or streamlets of water on the oil-painted party walls which bound our staircases,

and which are, therefore, absurdly said to sweat, though these walls have no communication with the outward air, and, from their varnished covering, cannot admit of the passage of moisture or perspiration through their pores.

In this case the remedy is obvious, and by its success shows the nature of the evil. Prevent your walls from ever becoming colder than the warmest external air of winter, and you will never have this appearance of damp on their inner surfaces.

This may be done, first, by constructing the walls of such a degree of thickness, or with such a disposition or quality of materials, that they shall not, in the usual way, be greatly cooled throughout their whole substance by any temperature of the outward air. With this view, I think that in all single houses, which are not warmed by neighbouring fires, and more especially in situations exposed to high winds, and therefore to great evaporation from the external surface, and consequent abstraction of heat, the walls should always be double, having on the inside a thin layer of brick, with an interval of one or two inches from the outer and thicker layer of brick or stone, to which it must be united by proper binders. The porous structure of the bricks, added to the impermeableness of the intermediate stratum of air, would so ill conduct heat, that such walls would necessarily tend to keep a house dry and warm in the winter, as well as cool in the summer. This end would be still further promoted by filling the interval between the two layers with dry sand, fresh sifted coal-ashes, or powdered charcoal. In fact, when the common external means before described have succeeded in curing dampness, it has been either by affording a varnish, which has diminished evaporation by preventing absorption, or by increasing the space or changing the quality of the materials of the wall through which the heat was to pass, so as in either of these cases to retain it more forcibly: and when the dampness has been remedied by removing the paper to some distance from the wall by means of strained canvas, that effect has been produced by rendering the paper a worse conductor of heat; and therefore indisposing it to condense the vapour in the room so readily as when it was in contact with the colder wall.

It has been suggested, that it would be possible to keep out cold, or, in more accurate language, prevent the egress of heat from the inside of a room, and therefore from the walls surrounding it, by shutting it closely up, and preventing any admission of the cold external air. This has arisen from the supposition that air is not a good conductor or transmitter of heat through its substance or pores, but that it merely carries it by changing place with some other portion which was less charged with it. If there were no other mode of abstracting the heat from the walls of a room, and if it were possible wholly to prevent any change of its air, this theory might perhaps apply. But it is not possible to prevent some exchange of this kind through the atmosphere of any habitable chamber; and it is evident from the moisture being most abundantly, or perhaps solely, deposited on the inside of that part of the wall which is most exposed to the external cold, that the chief or common mode in which the wall is cooled is not by the access of cold air into the room, but by the passage of heat from the wall itself into the cold air without. We may however so far avail ourselves of this principle, as to exclude as much cold air as we can, by shutting up the windows and chimnies of uninhabited rooms during the severity of frost.

It may further be suggested, that as, during a thaw, the air, being warmer than the frost, has a greater quantity of water in form of vapour mixed with it, shutting up a room on such occasions may, by retarding the admission of warmer air so charged with vapour, allow time for the walls to acquire an equable temperature through their substance from without, so as to anticipate any condensation on their surface, which might occur from the free admission of the external air. To this I only answer, as before, that rooms according to the common construction cannot be excluded from communication with the external air: and that, in fact, the dampness does under these circumstances take place, though the doors and windows are never opened.

In all cases, however, there is one method of preventing this species of dampness, which is infallible; and that is to keep every

part of the internal surface of the wall in the chamber or staircase sufficiently warm by good fires. With this view all staircases ought to have some means of receiving artificial warmth.

If, notwithstanding this and the former precaution, a wall should accidentally become damp, the next best expedient is to dry it as quick as possible by a free current of warm air.

This discussion, which at first sight might appear tedious and irrelevant, will, I trust, no longer be thought so, when it shall have been found necessary for the establishment of a principle on the subject more immediately before us.

In order to show the analogy, let us take the simplest example, which is that of a wainscoted room, unwarmed by fires. When the wainscot is colder than the air, it condenses the vapour in form of moisture. If that moisture were exposed to the influence of the sun and wind, the case would come under the former head of decay, which is that of wood wetted by rain in the open air. The water soon epavorates, and little decay proceeds in the wood. So in the wainscot, the surface next the room, though unprotected by paint, will perhaps be long in rotting, because the room admits of currents of air, more especially when doors and windows are frequently opened, so as to evaporate the superficial moisture, though less quickly and effectually than in the open air. But what is the case with the surface of the pannel next the wall? The air, loaded with moisture, penetrates into the intersticial space, and deposits it by condensation on that surface. But there is afterwards no current of air to evaporate the water so deposited, which then slowly decomposes and destroys that surface of the pannel. Such is precisely the process of the dry-rot, which always begins next the wall, and gradually proceeds to the painted or outer surface of the wood. It resembles in its chief circumstances the decay of paper in a damp room; and it resembles that of paper projecting from the wall on canvas, which will still often happen, if the wall be subject to acquire a very considerable degree of coldness, though much more slowly than in the former case.

The same process obtains in all other cases. Whenever the

wood is cooler than the air which it touches, the vapour is condensed upon it; and being exposed to new heat or current of air sufficient again to evaporate it, remains till another fit of condensation affords a new supply.

Thus the process of corrosion and decomposition is continually supported, till the wood moulders away.

The term dry-rot is, therefore, so far from being expressive of the real fact, that decay proceeds under these circumstances more quickly than in the open air, precisely because the wood is more constantly and uniformly wet: just as the lower parts of posts and rails, and any cavities in timber exposed to the weather, rot sooner than those parts which readily and speedily dry.

The smell which we perceive on going into vaults or cellars, where this process is going on, arises partly from the extrication of certain gases, mingled perhaps with some volatile oil, and partly from the effluvia of those vegetable substances, which have already been said to grow on it; and which, though they begin merely because the decayed wood is their proper soil, yet afterwards tend probably to the more speedy decomposition of the wood itself. They cannot, however, with more propriety be said to be the cause of the dry-rot, than the white clover, which appears on certain lands after a top-dressing of coal-ashes, can be said to have produced the soil on which it flourished.

I have remarked above, that sometimes only a particular sort or sample of timber has in certain situations rotted, while another piece has continued for a great length of time perfectly sound. Hence persons have been deceived, and been disposed to attribute the dry-rot solely and universally to some original peculiarity in the wood itself. Dr. Darwin explains this fact by telling us, that the wood so decaying has probably been cut in the spring, when the sap in the alburnum was not only abundant, but of a saccharine quality; which, in combination with the vegeto-animal substance or gluten, disposes it to run with unusual readiness into destructive fermentation. In some trees, as by more particular custom the oak, the bark is a very valuable article of commerce, and is found not only to quit the tree more readily,

but to contain a larger proportion of tan in the spring, when the sap is rising, than at other seasons. Hence an old act of parliament, now in force, ordains that all oak, except for the purpose of building, shall be felled in the spring. Whether doors, posts and rails, paling, barrel-staves, &c. come under the denomination of building, it may be difficult to say; but it seems at first view highly to be lamented that any law should impose an obligation to destroy a valuable species of property. It would indeed be matter of peculiar regret, if an impolitic and avaricious spirit should induce the owners of oak forests to extend the same principle to the timber employed in the construction of great machines, and more especially the British navy.

Various means have been employed in order to remove the tendency to the dry-rot in trees so felled. Thus they have been long exposed to the rain, or steeped, or even sometimes boiled in water, and then dried by artificial heat. These means do not however appear to have been successful in entirely washing out the fermentible sap, which therefore makes them much more subject to the decay of which we are treating. It may however still be doubted whether it acts in any other way than by furnishing a disposition, which requires to be called into action by the same cause which operates in all other cases, moisture.

In proof of what I have stated, I have been informed by one of our Vice-Presidents, that in a large vat or set of vats for beer, belonging to him, the staves formed of oak 2 1-2 inches thick, notwithstanding they were previously steeped in hot water, and then thoroughly dried, in a very short time underwent the dry-rot, while others in the same situation continued unchanged five or ten times that period. It is highly worthy of remark, that the outside of these staves, which was painted, continued sound, and that the decay began on the inside, where, from the vats being at different times more or less filled, they were subject to the joint and successive influence of moisture and air.

I have mentioned above, that the putrefactive fermentation cannot take place except in certain temperatures, the lowest of which, according to Thompson, must be but little below 45 de-

grees of Fahrenheit's thermometer, and the highest degree which produces dryness by evaporation. The temperature most conducive to this effect has not, so far as I know, been ascertained, though much useful information on this head might be obtained from a set of well-conducted experiments.

The following then appears to be the whole theory of the dry-rot; that it is a more or less rapid decomposition of the substance of the wood, from moisture deposited on it by condensation, to the action of which it is more disposed in certain situations than in others; and that this moisture operates most quickly on wood which most abounds with the saccharine or fermentible principles of the sap. Let us see how this theory corresponds with the best known means of prevention, and what more effectual measures it may suggest.

The first point is certainly to choose timber properly felled and well dried. And here, in order to prevent the injudicious fall of large oak timber, it may be of consequence so know that the bark of such timber contains much less tan than that of the younger and more succulent wood; and that this principle, together with the proper extractive matter, is considerably more abundant in the bark of the Leicester or Huntingdon willow, than in that of any oak. According to the experiments of Mr. Davy, 7 1-2 pounds of the former will go as far in tanning leather as 9 or 10 pounds of the latter. It has however been asserted, that if an oak, or any other tree, which is stripped of its bark, be suffered to stand two or three years before it is felled, the wood will have acquired a very great degree of strength and durability.

Next, where it is practicable, a current of air should be frequently made to pass along the surface of the wood. This expedient seems to have been particularly attended to by the ingenious architects of our Gothic churches, who are said, with that view, to have left various openings in the walls between the two roofs of those edifices. In order also to promote evaporation, a certain degree of heat, such as that of air heated by the sun or fire, should, if possible, be from time to time applied. Cellars themselves ought to have some communication with the outward

air by means of windows and shutters, or trap-doors: and that these may be for a short time opened in proper weather, so as to have a draught of air; and that no very low degree of temperature is necessary for the preservation of fermented liquors, provided that temperature be uniform, is evident from the practicability of keeping wine extremely well in cellars which are not damp, and in which, therefore, one or both of these circumstances must have taken place.

The destruction of wainscoting may be long deferred by keeping in the apartment suitable fires.

Lastly, the dry-rot may in all cases be infallibly prevented where it is practicable to cover the surface of the wood, properly dried, with a varnish which is impenetrable and indestructable by water. With this view, two or three coats of the composition before described should be laid on the dry wood, before it is erected or put together, and a third or fourth after it is put in its place; and proper means should be taken thoroughly to dry each successive coat of varnish. In situations of this kind, what means of preservation are necessary must be employed at first; as it seems scarcely possible to renew them on fixed timber with any chance of benefit.

I do not know whether in very damp situations, surrounded with stagnant air, these varnishes would not in time admit of the growth of fungi or mould. The brimstone might be supposed sufficient to preclude that effect; but, if we believe Braconnet, seeds of the white mustard sown in pure flower of brimstone, and well watered, became vigorous plants, which flowered and produced effective seeds. It is certain, however, that the essential oil of turpentine will act as a poison on growing vegetables; and perhaps the same property may exist in rosin, which seems to be a similar essential oil, united with a certain proportion of oxygen.

It is however highly probable, that the union of the brimstone may have another good effect, which is to prevent one of the causes of the destruction of timber which I have before mentioned, the depredations of insects. Whoever would learn the

havoc which certain animals of this kind are capable of making in hot countries, would do well to read Smeathman's description of the Termes, or White Ant, originally published in the Philosophical Transactions, and from thence abridged into the English Encyclopedia Britannica, and other collections. In this country we know little of such ravages. Mischief, however, of this kind does sometimes occur, and may be the work of various animals, a particular account of which may be met with in the fifth volume of the Transactions of the Linnæan Society.

I am informed, that in India, a circle of Lord Dundonald's coal-tar drawn on the floor round boxes and other furniture, will effectually preserve them and their contents from the depredations of the white ant.

It appears that most insects are fond of sugar and mucilage; which is the probable reason why that wood is most subject to be penetrated by worms, which is felled when it most abounds with sap. In such cases, it might be well to try the effects of washing the wood, previously to the use of the varnish, with a solution of arsenic in hot water, in the proportion of 1 lb. to 10 gallons; or with a strong decoction of coloquintida or bitter apple, or white hellebore; after which the wood must be completely dried before the application of the varnish in the manner before directed. All these preparations are extremely cheap, and are either destructive or offensive to insects, and therefore will, probably, be an effectual defence against any injury from that cause.

ON THE PRINCIPLES

OF IMPROVING

THE BREED OF DOMESTIC ANIMALS.

EVERY one, whose opportunities have permitted, must have remarked, that the agriculture of Pennsylvania has very materially improved in the course of the last twenty years. This

change has been effected by the free use of lime, gypsum,* and the introduction of green and root crops, and their alternation with those of grain, by which means abundant food for all domestic animals is furnished, manure rapidly accumulated, and the strength of the land kept up. It cannot however be denied, that in all kinds of farm cattle, there is much room for improvement, and that in respect to fine neat cattle, our deficiency is very great. With a view therefore to assist those who are anxious to undertake the important and profitable measure of improving their stock, the following hints are given. They are the result of remarks of professed breeders and improvers in England,† tested by the experience and observations of the Editor, and other members of the Cattle Society of Pennsylvania.

Until about fifty years since, no attempt had been made to change the state of farm cattle in England. Before that time, no country possessed animals of worse forms. Size was the only object of consideration, and form was never taken into view. Hence large big boned, coarse headed, narrow rumped animals were the fashionable stock of the day. Some of those worthless beasts were imported into the United States before the revolutionary war, but they are now happily extinct. They are still abundant in England, as appears by Mr. Nicholson's letter in page 295.

A few ingenious and observing men, perceiving the loss sustained in feeding such animals, commenced the attempt to alter their forms, selecting and breeding from what they deemed the best shaped without regard to bulk. Mr. Bakewell of Dishley, in the county of Leicester, continued to advance the desirable properties of the race upon which the experiment was first made,

* For a full account of the fertilizing effects of *gypsum* on grass, and on other vegetables, its mode of application, &c. see the Treatise of Mr. Peters on *Gypsum*, the Memoirs of the Agricultural Society of Philadelphia, vols. 1—2. and the Domestic Encyclopœdia, Philadelphia edition.—For remarks on *lime* as a manure, see the two last mentioned works.

† The authorities consulted, besides those quoted, are Lord Somerville, Cline on the form of animals; Lawrence on Cattle, and Sir John Sinclair.

and since his time, others have followed with great success, and have found out in what respects, even the favourite forms of that original character might be altered for the better. "Mr. Bakewell, after breeding *in and in*, through a great number of descents, ever selecting individuals of the roundest form, and smallest bone, raised that variety which has been since so celebrated for aptitude to acquire external fat. But in the attainment of this end, he sacrificed the quality of great milking, and rendered the animals less certain in the faculty of procreation."* The fat morever, not being diffused through the flesh, but lying in thick layers externally, was a great objection, as much waste necessarily ensued in cooking. The same thing occurred in the Bakewell or Dishley sheep, on the ribs of which the fat has often measured seven inches, while the flesh was not one inch thick. These defects led to further experiments, and occasioned the origination of other breeds, some of which shall be noticed in the sequel.

The first object that naturally offers to be attained, is the possession of a breed of cattle, which, with a given quantity of food, will afford the quickest and greatest return of the most valuable parts of flesh, or of milk or butter. After repeated experience and close attention to the subject, by European improvers, it has been found, that so far as flesh is concerned, there are certain forms and proportions of body, intimately connected with the great object in view, and these shall now be detailed.

1. Of a Bull.—The head should be rather long, and small, muzzle fine,† chaps clean, eyes lively and prominent, ears long and thin, horns tapering, bright and spreading; *neck fine*, rising with a gentle curve from his shoulders, and small and fine where it joins the head, progressively leading down to a full and deep bosom; shoulders moderately broad at the top, joining full to the

* Lawrence on Cattle, page 62.

† Lord Somerville, who does all his farm-work with Devon oxen, says, that with respect to that particular breed, "a black nose is often a sign of a bad constitution, of such as turn scourers, and particularly when the cast of the coat is of too pale a colour." It may be well for the American improver to notice how far the remark applies in this country.

chine [crops] and chest; breast broad, and projecting well before his legs; his arms or fore-thighs muscular and tapering to his knee; his legs clean, straight, and very fine boned, and standing wide; his chine and chest so full as to leave no hollows behind the shoulders; the plates strong, to keep his belly from sinking below the level of his breast; his back or loins broad, straight and flat; his ribs rising one above another, in such a manner that the last rib shall be rather the highest, leaving only a small space to the hips, the whole forming a round, barrel-like, but capacious carcase: his hips should be wide, round, and a little higher than the back; the rump wide, and lying in a horizontal direction, and not sinking backwards, but even with the general level of the back; the huckle bones [rump bones] not in the least protuberant; the tail should be thin, round and tapering, not hairy, and set on so high as to take in the same horizontal line with the back: it should moreover be broad at bottom, to prevent the appearance of the cavities at the nache: and the gristles at the setting on of the tail should rather project on each side, as they accumulate much fat in this part. The skin should be mellow and elastic, yielding pleasantly to the touch, especially on the chine, shoulders and ribs; feeling soft, though firm to the touch, and equally distant from the dry hard skin, or loose flabby feel.

As some reasons may be expected for the minuteness of this description, the following are offered.

A small head facilitates birth; if it be not neatly let into the line of the neck, and if the points of the shoulders push downwards, the neck appears out of proportion, the weight or strength which ought to be in the closing or junction of the shoulders at the top is destroyed, and the end of the chine at that part is thin and hollow, and the due symmetry of the part is destroyed. An animal with a dull eye rarely fattens well. The loins being narrow and thin, and the feet standing close, are signs of weakness, and very unsightly defects: when the fore-legs approach too near, it may be also presumed from the consequent narrowness of the chest, that there will not be sufficient room for the action of the lungs, during the period of fattening, and as on their size and

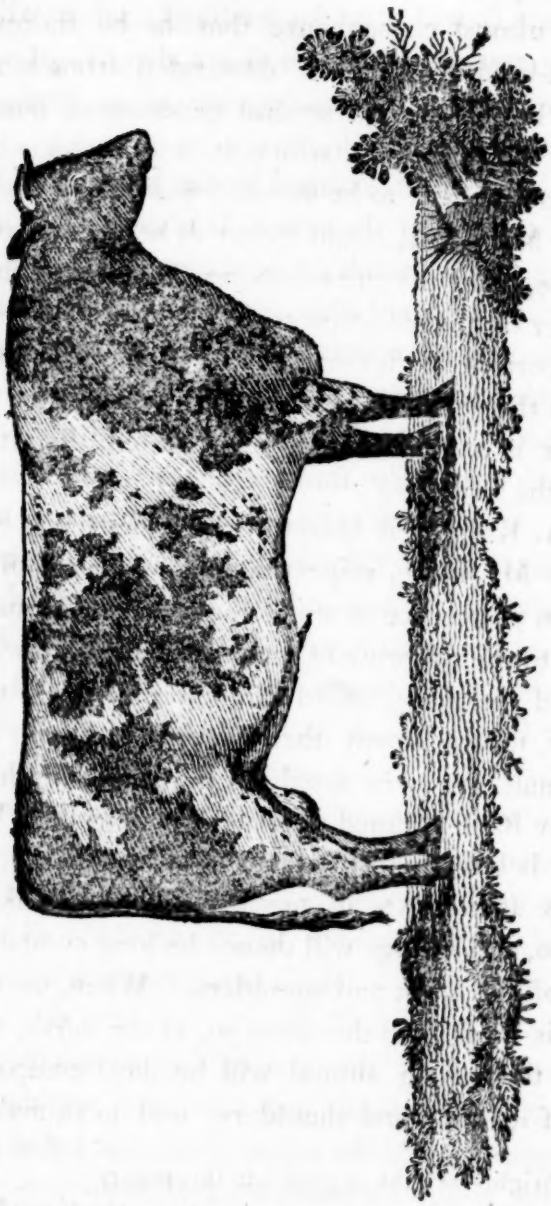
soundness, the strength and health of the animal, and his power of converting food into nourishment principally depend, it is of the first importance to attend to the formation of the chest.* If a bullock is in-kneed, or the knees bend inward, the points of the toe and of the shoulder must be out; and he must be hollow behind the withers (a bad point for feeding), and he will, of necessity, be a slow worker. A hairy tail is indicative of a hairy head and large bones, and of a coarse opened grain flesh, or "gumminess."

The pelvis is the cavity formed by the junction of the haunch bones, with the bones of the rump. It is essential that this cavity should be large in the female, that she may be enabled to bring forth her young without difficulty. The size of the pelvis is chiefly indicated by the width of the hips, and the breadth of the twist, or the space between the thighs. The breadth of the loins is always in proportion to that of the chest and the pelvis. Small boned animals invariably fatten quicker than those of larger bones, which often are the result of an imperfect nourishment during growth, and generally indicate an imperfection in the organs of nutrition. When a hide feels soft and mellow, it strongly indicates a tendency to take on meat, and it is evident, that a fine and soft skin must be more pliable, and more easily stretched out to receive any extraordinary quantity of flesh, than a thick or tough one. At the same time, thick hides are of great importance in various manufactures, and are necessary in cold countries, where cattle are much exposed to the inclemency of the seasons; and in the best breeds of Scotch Highland cattle, which are much prized in England, the skin is thick in proportion to their size, without being prejudicial to their capacity of fatting.

Finally, whatever be the size of the animal, just and equal proportions of length, depth and substance, are the truest indications of vigour, and of the ability of the animal to produce and stand under the greatest possible load of flesh.

* Cline on form of animals.

The annexed cut of a Teeswater Bull, from Tuke's survey of Yorkshire, will serve as a specimen of one of the improved breeds of cattle in England.



By improvement of the breed of animals, Lawrence means the gradual change of form and property in their progeny, until they shall arrive, as nearly as possible, to a certain standard of pre-

sumed perfection. This is to be effected by a conjunction of male and female, of the desired species, form, and properties; some steps being gained in every procreation. The male, of course, being able to multiply his likeness to such an extent, must be the prime instrument in the business: it is therefore of the utmost consequence that he be thorough-shaped, or thorough-bred: "That is, descended from a race of ancestors, who have, through several generations, possessed, in a high degree, the properties which it is our object to obtain."† The female ought also to be selected with the strictest care, and according to Mr. Cline, ought rather to be proportionally larger than the male, since the improvement depends on this principle, that the power of the female to supply her offspring with nourishment in proportion to her size, and to the power of nourishing herself from the excellence of her constitution. In this particular, an error is very commonly committed, the attention being confined to the male.‡

Mr. T. A. Knight, of Herefordshire, objects to the principle laid down by Mr. Cline, respecting the advantages of propagating from large in preference to small females. "Nature," he says, "has given to the offspring of many animals, (those of the sheep, the cow, and the mare, afford familiar examples) the power, at an early age, to accompany their parents in flight; and the legs of such animals are very nearly of the same length at the birth, as when they have attained their perfect growth. When the female parent is large, and the fœtus consequently so, the offspring will be large at its birth, in proportion to the bulk it will ultimately attain, and its legs will thence be long comparatively with the depth of the chest and shoulders. When, on the contrary, the female is small, and the fœtus so, at the birth, the length of the legs of the young animal will be short comparatively with the depth of its chest and shoulders: and an animal, in the latter

† Sir J. Sebright—see the appendix to this paper.

‡ In the case of horses, perfection consists in the "wind," and this, according to Mr. Robson, an eminent trainer at New-Market, "depends on parentage, and on the female most."—See Sir John Sinclair, on athletic exercises.

form, will be greatly preferable, either for the purposes of labour, or of food to mankind. I have seen this difference in the influence of the male and female parents on the offspring, very strikingly exemplified, in the result of an attempt to obtain very large mules from the male ass, and the mare. The largest females, that could be procured, were selected, and the forms of the offspring, at the birth, were perfectly consistent with the theory of Mr. Cline; they were remarkably large, and I observed, that the length of their legs, when they were only four days old, very nearly equalled that of the legs of their parents. I examined the same animals when five years old, and in the depth of their chests and shoulders, they very little exceeded their male parent, (a Spanish ass) but from mares of mall stature, were perfectly well proportioned.*

"There is another respect in which the powers of the female appear to be prevalent in their influence on the offspring, and that is relative to its sex. In several species of domesticated, or cultivated animals, (I believe in all) particular females are found to produce a very large majority, and sometimes all their offspring, of the same sex; and I have proved repeatedly, that, by dividing a herd of thirty cows into three equal parts, I could calculate, with confidence, upon a very large majority of females from one part, of males from another, and upon nearly an equal number of males and females from the remainder. I frequently endeavoured to change these habits, by changing the males, but always without success; and I have, in some instances, observed the offspring of one sex, though obtained from different males, to exceed those of the other, in the proportion of five or six, and even seven to one. When, on the contrary, I have attended to the numerous offspring of a single bull, or ram, or horse, I have never seen any considerable difference in the number of offspring

* It is probable that different species of animals differ in respect to the influence of the size of the parents on their progeny. I have known a pair of noble carriage horses, got out of a diminutive mare, by a large and well formed horse; while, on the contrary, in the case of sheep, the influence of the size of the mother upon that of the young, is certainly great, as already stated, p. 90. EDITOR.

of either sex. I am therefore disposed to believe, that the sex of the offspring is given by the female parents."*

Mr. Knight is well known for his attentive and successful investigations of nature, animal and vegetable, and his conclusions have, in this case, he says, been drawn from very extensive and accurate observation.

To obtain the most approved form, two modes of breeding have been practised, one by the selection of individuals of the same family, called breeding, "in-and-in;" the other, by selecting males and females from different varieties of the same species, which is called "crossing the breed."

When a particular variety approaches perfection in form, breeding *in-and-in* may be the better practice. In following this, however, great caution is requisite in selecting the best shaped individuals. It was thus, the celebrated *Bakewell* preserved his various stock, without degeneration in any of the qualities for which they were famous. But as, in the United States, the origination of a breed of neat cattle is to be aimed at, the system of crossing must be adopted, and for this end, the following rules should be attended to.

Mr. Lawrence remarks: "Individual variety of size and shape prevails in all breeds, to the infinite use and convenience of man. Some will run naturally to length and depth of carcase; others, will have a tendency to the contrary form, or with much substance, wide loins, and short legs. The improving breeder, in joining the sexes, will take advantage of these varieties of shape or peculiar properties; increasing length and depth of carcase, when required, or moderating too great length with its opposite,—with rotundity of form, and width of loin, and shortness of leg; ever having especial regard to preserving *substance* in the form of his stock, and to prevent the increasing length and too near approach of the legs. It is very common for the best breeds to degenerate in this way from neglect; in which case it will be necessary to change the males for others of a still shorter and more substantial form, either from the same or a kindred variety, and to pay an increased attention to the selection of females."

* Transactions Royal Society London, 1810.

Disposition. "It is of great importance to have a breed distinguished by a tame and docile disposition, without however being deficient in spirit. Such a breed is not so apt to injure fences, to break into fields, and unquestionably less food will rear, support and fatten them. As tameness of disposition is much owing to the manner in which the animal is brought up, attention to inure them early to be familiar and docile, cannot be too much recommended."* Mr. Bakewell attended sedulously to this point; and his breed of cattle retain it to this day. He kept them in stalls, and attended them with the same care that others do a favourite horse. A bull of his stock, exhibited at the Cattle Show, in April last, by Messrs. Ely and Eastburn, was as gentle as a cart horse.

Hardiness. "This is a most important requisite. Even where stock is most attended to, it is of essential consequence that they should be as little liable as possible to disease, or any hereditary distemper, as being black fleshed, or having yellow fat. It is a popular belief, that a dark colour is an indication of hardiness, and that cattle with light colours are softer and more delicate. A rough pile is also reckoned a desirable property in *out-winterers.*"

Easily maintained. "On an attention to this point depends the profit, in a great measure, of the grazier. It is intimately connected with the shape above mentioned, and with smallness of bone." In the horse, every one knows that certain shape is indicative of being easily kept, and the remark will apply to neat cattle.

Early maturity. "Arriving soon at perfection, is a material object for the breeder, as his profit must in a great measure depend upon it."* Something will certainly depend upon their being fed in such a manner as to keep them constantly in a growing state: in this way, they make more progress in three years, than they usually do in five, when they are half starved during winter, and their growth checked. By the letter (page 294) from Mr. Nicholson, of Gipton, near Leeds, in England, it ap-

* Sir John Sinclair—Farmer's Magazine, vol. 3.

pears that his breed of cattle possesses this valuable requisite in a most remarkable degree. His bull, which was sold for 100 guineas, weighed 2240 lbs. live weight at three years and two months old. His fore quarters were supposed to weigh 1560 lbs. He was kept for cows, and it is probable had only common pasture, when weighed. Six beasts, three years and a half old each, sold for 38*l.* 6*s.* sterling each, or $ 170 22. The four quarters of each weighed 1316 lbs. In this country, such weights would be thought great in beasts of five years old, which had been well wintered, grazed the following summer, and stall-fed in the succeeding winter.

Let the spirited breeders on our frontiers make a calculation, as to the great increase of price they would obtain from the grazier, for cattle coming so early to maturity as those just mentioned and reflect on the profit from selling their poor cattle at two years of age instead of five or six years; and let the grazier calculate the difference to him between keeping cattle one year, instead of fifteen or eighteen months, and the saving of some hundred bushels of corn meal by stall-feeding, and then say, whether there is not room for improvement in our stock.

Quality of flesh. "The quality of flesh most certainly depends much upon age, and sex; heifers, for instance, must be finer grained than oxen;" and the coarseness of stag beef is proverbial. The excellence of the meat also greatly depends upon their food, and the nature of the soil producing it. On the whole, there is no better sign of good flesh, than when it is marbled, or the fat and lean nicely and alternately mixed with each other. The person who would, in the United States, originate a breed, in which we might always be sure of finding such beef, or who would discover the particular marks by which such cattle might be known, would deserve one of the highest premiums our Cattle Society could bestow, and be otherwise well paid for his trouble.

Working. In the case of working oxen, a quick step, and strength in proportion to speed, are of the greatest importance; and that these qualities may be imparted to an ox, there can be little doubt. In England, they are supposed to have been ob-

tained by an admixture of the lighter, small boned French, Norman or Guernsey breed, with some of the native breeds. Their gentleness of disposition, mildness and hardihood, also serve to recommend the French breed. When well kept, they grow to good sizes, although naturally small.* In the U. States, a great diversity is found in respect to the gait of oxen; for while some are slow, others will walk nearly as fast as a horse. The formation of their fore-quarters, as before noted, will greatly influence their speed. If a breed could be originated, which, with the above mentioned qualities, this of quickstep were joined, a great object would be obtained, and would amply repay the breeder.

It may be asserted with safety, that in no country does the dairy-man receive greater prices for his milk, butter or cheese, than in the United States; and yet it is notorious, that the cows in general are far from excellent. The abundant provision required for the support of stock, during our long winters, ought to insure a plentiful supply of rich milk in summer, and yet it is believed that the profit from them is much smaller than is commonly imagined. We are much more deficient in this article of farm stock than in any other, which calls loudly for the attention of the improver. The indications of form, which so strongly characterise the profitable cattle for beef, fail with respect to milk, as we find that some of the most excellent milk breeds are very different in external form. The surest mode of procedure for the improver, is to breed from good milkers, that is, such as give rich milk, and if possible, from such as possess the forms approved of for bulls in the preceding pages, making allowance for the difference of sex. There are, however, some marks of a good milch cow, in every breed, which it may be useful to note, viz. a capacious and thin-skinned udder, large

* In France, oxen are very generally used to plough and for draught. It is probable therefore they are more speedy in their gait than the native breed of England, or than the common breed in this country. Some of those French breeds have been introduced into England, and much admired. See Bath Memoirs, vol. ix. introduction, p. 33, and Commercial and Agricultural Magazine, London, Vol: 9. p. 292.

teats, with a large and distinct milk-vein; fine head and chaps, thin neck, shallow and light fore-quarters, capacious behind, wide loin, thin thigh, and white horns. A gaunt and meagre appearance of body, promising no great disposition to fatten, is added by some as a sign of a good milker; but although good milkers are often of a thin habit, yet there can be no reason why the rule should be absolute; and on the contrary, we see in Tuke's survey of Yorkshire, portraits of Teeswater cows, that must from their formation take on fat readily, and they are well known to be first rate milkers.

To shew the inferiority of the produce of our cows, when compared with those of England, a few facts shall be stated. Sir John Sinclair* states, on the authority of W. Trevalyan, Esq. of Northumberland, that a well bred Teeswater cow will give on an average 14 quarts at each of two milkings, or 28 quarts per day. Some of the Teeswater breed, according to Culley,† give even to the amount of 36 quarts per day. The cows of the island of Alderney, and other islands on the coast of France, give very rich milk, though not in the greatest quantity. Lawrence says,‡ "he was assured by a respectable friend, that an Alderney strayed cow, during the three weeks she was kept by the finder, made nineteen pounds of butter each week, and the fact was held so extraordinary as to be thought worth a memorandum in the parish books." A cow of the same breed was imported into Philadelphia by Mr. Charles Ross, and in his possession she made nine pounds of butter every week. Cows from north Devonshire, keep in good order, are hardy, their beef is fine grained, and they are so easily maintained, that one acre and a half of prime pasture is the allowance for one cow a whole year, during which time each cow will fatten five calves.§ A Sussex bred cow

* Farmers Mag. Edinb. Vol. 3.

† On Live stock, p. 40.

‡ Lawrence on cattle, p. 87.

§ The business of purchasing calves from the London cow keepers, and taking them to the country for the purpose of fatting for market, is followed by many persons within a few miles of London.

owned by Mr. Cramp of Lewes, cleared one year 43*£*. 5*s*. 11*d*. and the second year 30*£*. 16*s*. 1*d* as stated in p. 289—290.

To those who have been contented with the common cows brought to them by drovers, or picked up in the neighbourhood, and the extent of whose travels has been from market back to their farms, and to an election ground, and who despise all information derived from books, some of the facts just mentioned will pass for fable; but of their authenticity there can be no doubt: the fact respecting the production by the Alderney cow may at any time be verified, and in order to be assured that it is possible to have better cows than their own, they need only visit Mr A. Deveas, and Mr. Shukert of Germantown near the Drover tavern, where they may see two cows which give from 10 to 12 lbs. of butter every week: and Mr. G. Hoppel lately had a cow which gave 15 lbs. of butter a week.

These facts ought to convince every one who is anxious to make the most of his farm, of the great room there is for improvement, and should rouse him to the attempt.

The combination of the valuable properties in a breed of milk, and beef, is so important, and has been thought to be so difficult of attaining, that it has been recommended not to attempt the union, for in proportion as we gain in one point, we lose in the other. We know in general, that good milkers are seldom quick feeders. The two objects have however been accomplished to a certain extent in England, in the case of the North Devon cows,* and in some individuals of the Kyloe or Highland breed,† and in the Suffolk Duns; and there is no reason why the same success should not attend equal industry in this country. Mr. Cramp's cow before noticed, was always ready for the butcher, but then other food besides grass was regularly given to her. It has been said indeed, by some, to be the result of their remarks, that "the cow which gave the greatest quantity of butter in a given time fed fastest when dry;"‡ but that the remark did not apply to *thin* milkers.

* Commun. Board of Agriculture, Vol. 4, p.

† Anderson's Recreations, Vol. 3d, p. 95—96.

‡ Farmer's Magazine, Edinb. Vol. 7, p. 177.

It is to be regretted that opportunities for the improvement of stock of neat cattle by means of the improved breeds of Europe are so few, and that even the knowledge of the existence of any among us is so partially diffused. It is understood that some very high priced cattle were imported into Maryland before and since the revolutionary war from Europe; and that within a few years past, more have been imported into the frontier parts of the state of New-York, but their particular qualities are scarcely known beyond the immediate vicinity in which they were introduced.* A breed from Holland, very valuable for milk and beef was imported some years since into Philadelphia, but the original stock was killed before the full blood was obtained. His progeny however evince such qualities as lead us to consider his death as a national loss. The original sire was sent to Lancaster county, where only a few of the first cross from him remain. Six steers of his stock which were fatted in the neighborhood of Lancaster during the year 1808, were pronounced by a competent judge† to be the handsomest cattle he ever saw. The fine ox fed by Mr. Guyer, and killed in Philadelphia, March 1808, was from a cow of that breed, by an English bull, now or late in the possession of Mr. Bunting of Neshaminy.

In the scarcity therefore of good foreign breeds, we must have recourse to our native stock, and it is a great satisfaction to know that there are excellent materials among us, on which we may commence the attempt. We every year see beasts of good form brought down in droves from various quarters, and sacrificed, after performing their duty for a season in a herd of cows; and which if kept as breeders would naturally improve the stock of the district. As a general rule, let no offspring be raised ex-

* Information respecting those cattle or any other valuable breed in the United States, will be thankfully received by the Editor. Parkinson the English, farmer who came to this country a few years since, and settled near Baltimore, also brought with him some stock, which were sold on his failure:—it would be desirable to know what are their merits.

† Thomas Smith, Esq. of Tinicum.

cept from the finest boned, cleanest headed, straight backed, and best fleshed of every stock, both male and female.*

A close adherence to those principles of choice at home, and in occasional purchase at markets, will soon convince any man how striking the improvement of his stock might become in a few years, and we look forward with great satisfaction to the period when the effects of our recommendation shall be shown.

Sir John Sinclair sums up the desirable qualities of cattle as follows.

1. A moderate size, unless when food is of a nature peculiarly forcing.
2. Shape the most likely to yield profit to the farmer.
3. Of a docile disposition, without being deficient in spirit.
4. Hardy, and not liable to disease.
5. Easily maintained, and on food not of a costly nature.
6. Arriving soon at maturity.
7. Producing considerable quantities of milk.
8. Having flesh of an excellent quality.
9. Having a tendency to take on fat.
10. Having a valuable hide. To which may be added,

Lastly, calculated (if judged necessary) for working.

2d. *Of a Ram.* The head should be fine and small; the eye prominent and lively, the ears thin, but not regular, the collar full from the breast and shoulders but tapering down; the shoulders should be broad and full, joining to the collar forward, and a chine backward in a straight line, so as to leave no hollow in either place; the mutton upon the fore thigh should come down to the knee, the legs should be straight, with a fine clean bone,

* The late Colonel Pollen, a British officer, and well informed on the subject of cattle, passed through the United States in 1802, and mentioned in a note to a gentleman of Philadelphia, that he saw "a breed of cows near Lancaster, with a fine small head, smooth and delicate hair, small eye, round rib, and straight back, which would be an acquisition to England if introduced there." This remark, made by an intelligent foreigner, who was well acquainted with the improved breeds of England, ought to have its due weight, and should stimulate us to attend to the animals we meet with, which may possess some valuable properties.

free from superfluous skin and coarse hairy wool, from the hough and knee downwards: the breast should be broad, and project well before the legs: the fore legs should be wide asunder; the back and loins broad, flat and straight, and from the ribs should rise in a circular direction; the hind quarters should be long and full, with the mutton down to the hough, which should be wide and rather boning out.* In the Merino race a rosy hue in the skin, and abundance of yoke or natural grease in the fleece, are peculiarities denoting health and high proof.

Wool is divided into two kinds, viz. long or combing, and the short or carding species, in both cases the thicker and finer the fleece the better. The particular species whether long or short woolled, having become fixed on, it will be found best to adhere thereto, and not to cross with a view to the division of properties. Thus an attempt to produce a mixture of the long and short woolled breeds, might in all probability disappoint expectation, and not be useful for either combing or carding. Length of staple in the long woolled breed, and fineness, elasticity, and closeness in the short-woolled fleece, will be the best guides in this case.

In all cases the carcass of the animal ought to be amply and regularly covered; it is a great defect when the belly is bare, as is too often the case with the American sheep, and a still greater when the wool is thin and open along the ridge of the back,† admitting rain which washes out the yoke or natural grease and chills the animal. At shearing time, notice should be taken of the fleece when cut off, and if it be stichy-haired at the bottom or part of separation, it should be marked for fatting. In the formation of a stock, such sheep should be avoided. In a general way, those should be chosen for breeders that have the finest, closest pile or thickest fleece, and have the greatest uniformity in the texture of the whole fleece, and are in the best condition at the time, provided the pasture has been nearly equal.

In various parts of the United States, sheep of good forms and valuable fleeces are to be seen; but few persons have attended to

* Culley on live stock.

† Lawrence, p. 303.

the preservation of their stock, with that care which a measure so important deserved. Within a short time however the eyes of the public have been opened, and it is to be hoped that the debasement of a valuable stock by the neglect and unrestrained intercourse with inferior rams, will be not longer permitted. Those anxious to improve, should make it a point to preserve the best formed and most thriving of their lambs for breeders, whether ewes or rams, and carefully put away, or fatten all those of inferior forms or of less thrifty dispositions.

Of imported sheep we have four kinds, and all valuable. viz. Spanish or Merino, Broad-tailed or Tunis, Irish, and New Leicester breeds, on each of which a few remarks shall be made.

The Spanish or Merino sheep are universally known for the superior fine quality of the wool, and it is agreeable to know that so far from degenerating in this country, the improvement in fleece is evident in proportion to the increase of blood.—It is a fact that upon some occasions, the very first cross between the Spaniard and American ewes gives lambs, which in the course of even the first year attain to a greater size than the sire :—that the mutton is excellent; that the crosses fatten in much less time than the common sheep of the country:—that they are very hardy, healthy, and do not become sick when fat, nor are they affected by the pelt rot, like our native sheep in winter, if kept in good heart, (as they always should be); nor do they shed their wool in the spring; that their bodies are completely covered, and lastly, that the ewes make excellent nurses.

It may be necessary to repeat to the American improver, that no judgment can be formed with respect to the ultimate quality of the wool or forms of this breed from the appearance of the lambs, until they are upwards of a year old; and for this reason, no males of the higher bloods should be sold, until the second year, unless they are defective in form.

The facts stated with respect to the importance of the female in all attempts to improve form, particularly apply to the case of sheep. One objection to the Merino breed, which frequently has been offered by those who consider size as all impor-

tant in cattle, is the general diminutive appearance of the full blooded rams. But it should be known, that it is upon the mother, we must principally depend for an increase of carcase, and for improvement of form. The sire gives the fleece; a due attention therefore to the size and form of the ewes in the formation of a flock, is of the first consequence to insure success. These principles, hitherto but little known in this country, will probably admit of controversy, or excite doubts, but their accuracy has been repeatedly demonstrated by the experience of numerous intelligent breeders, and by all those European improvers, who have favoured the public with the result of their experiments and observations.

The idle notion, that Merino sheep can produce fine wool only in Spain, has been amply disproved by Lasteyrie, and by the result of the experience of the English and American improvers.

In France, owing to the care taken to provide plenty of food at all times; to the selection of the largest and best formed and finest woolled ewes and rams for breeders; and to not using either until the second year; the flock of the national farm have been brought to carry finer and heavier fleeces, and to be better formed than any in Spain. The long journies which the Merino breed in Spain are obliged to take, to procure food every day, owing to the numbers kept together, and which are absurdly supposed to contribute to the preservation of the fine quality of the wool, tends on the contrary to diminish their size, and injure the wool; for instead of laying down to chew their cud, after they have filled their stomach, they are forced to march several miles, and "by this forcible deviation from the laws of nature, their digestion is impeded, and nutrition, and consequent growth, is proportionably defective."*

The Merino race affords a variety of advantages over every other kind of sheep, and ought therefore under the present circumstances of the country, to demand the first attention from our farmers. Mr. Livingston has remarked, and with great

* Parry, page 467.

truth, that wool, in the United States is more valuable, and is certainly more scarce than meat; while the contrary is the case in Europe, and particularly in England. Merino wool sells from 75 cts. to 2 dolls. per lb.; and from the increasing number of manufactories in the United States, will for many years command those prices; for the consumption of fine cloth will increase in proportion to the readiness with which it can be obtained. But the fact is, as already stated, that this breed having a fair chance, yields good mutton, as well as good wool.

The Barbary breed of sheep with broad tails, carry good and long wool, and fatten easily and to desirable weights.*

The Irish breed is confined principally to the vicinity of West Chester in this state: they fatten to great weights at three years old.

The possession of the new Leicester sheep may be justly deemed a treasure to the United States, where from great inattention, most of the breeds formerly among us have become worn out, so that they are difficult to fatten, and have degenerated in form.—

We owe the introduction of this valuable breed to the spirit and exertion of——, Beans, now of New Jersey, who succeeded in shipping some rams and ewes from England, a few years since; the full-blood descendants of which are exclusively in the possession of Capt. Farmer of New Brunswick, New Jersey. But their progeny is distributed throughout the state of New Jersey, and a part of Pennsylvania.

The barrel shape of the bodies of the New Leicesters, their very gentle disposition, and natural indolence, cause them to take on fat very speedily, and hence answer admirably to cross with the narrow backed, flat sided, long legged breeds. The objection to the full breed in England is the same that is made to all the stock of Bakewell, viz. a too great tendency to take on external fat without a due proportion of lean. This objection will not apply to the cross with most of the American sheep, in which all addition of fat may be considered as clear gain. The

* For a more particular account of this breed, see memoirs of the Agricultural Society of Philadelphia.—Vols. 1—2.

object to be aimed at by the assistance of the new Leicester sheep, is the origination of a breed by crossing with our native stock, which will increase the tendency to speedy fatting, without diminishing the due proportion of flesh, so desirable in all stock, and to this object I beg leave to direct the attention of the American improver.

SWINE.

A great diversity of breeds of Swine are found in all parts of the U. States, some of which are highly valuable, and others very worthless. Several persons within my knowledge have hogs which at 15 and 18 months old, will weigh 300 lbs. and upwards. Of the foreign breeds near Philadelphia, only two are distinctly and accurately marked, viz. the African and Chinese. The first is most commonly white, of good shape, wide behind, small pointed ears, and a pouch on each jowl. They will fatten with less food than almost any other breed; have very thin skins, and very small bones: at four weeks old will weigh ten and a half lbs.; hence they take the lead as roasters in our markets. At 18 months they will weigh from 150 lbs. to 250 lbs., but are ripe with good keeping at 12 months.—The objection to them is, that they incline too much to fat, and throw it on the outside, and do not marble the flesh, and hence are most fit for the labouring class. When deep in the blood, they become so fat, merely by grazing and having the common slops of a farm, as to diminish their disposition to procreation. For these reasons, a cross with some of the common breeds forms an evident improvement, for more flesh is thus acquired, than is possessed by the African, while the superior tendency of the latter speedily to take on fat, is what our common breeds are lamentably deficient in. In this way, I have produced a stock of hogs the beauty of which cannot be exceeded. I regret that I omitted to record the particular weights of several parcels of hogs I have killed, but I am glad to be enabled to supply my deficiency by the following statement from Job Roberts Esq. of Montgomery County Pennsylvania, no less known for his excel-

lent farming and zeal for improvement, than for his accuracy, and the upright discharge of his duty as a magistrate.

"Last autumn (1808) says he, I killed nine hogs, which weighed 1956 lbs.; one of them was two years and three months old, and weighed 321 lbs. the other eight were fifteen or sixteen months old, and averaged upwards of 200 lbs. each; for the last six months before penning, they had no kind of grain whatever, and but little milk, (that being given to small shotes for the market) they subsisted on clover and other grass, as they run with my cows during the summer; two or three weeks before penning I gave them plenty of pumpkins, and after penning, gave them twenty bushells of corn to harden their meat. I am of opinion that the food required to raise and fatten the said nine hogs, would not have been sufficient to have made 1000 cwt. of pork of any other kind of hogs that I have had, and I have generally endeavoured to obtain the best."

The Chinese hogs are invariably black, fatten easily, are smaller than the African, are very prolific, have thick skins, hollow backs and pendant bellies almost touching the ground; their tails are curled and in perpetual motion.—It is extremely desirable to originate a breed which shall partake of the disposition to fatten speedily, and at the same time will diffuse the fat through the flesh.

I shall conclude the subject of the improvement of the breed of cattle, by the following observations of Sir John Saunders Sebright, Bart. M. P. contained in a small pamphlet* recently received by the Editor.

"WERE I to define what is called the art of breeding, I should say, that it consisted in the selection of males and females, intended to breed together, in reference to each other's merits and defects.

It is not always by putting the best male to the best female, that the best produce will be obtained; for should they both have a tendency to the same defect, although in ever so slight a degree, it will in general preponderate so much in the produce, as to render it of little value.

* "The art of improving the breed of domestic animals, in a letter to Joseph Banks, K. B. by Sir John Saunders Sebright, Bart. M.P.—London—Harding, 1809."

A breed of animals may be said to be improved, when any desired quality has been increased by art, beyond what that quality was in the same breed, in a state of nature: the swiftness of the race-horse, the propensity to fatten in cattle, and the fine wool in sheep, are improvements which have been made in particular varieties of the species to which these animals belong. What has been produced by art, must be continued by the same means, for the most improved breeds will soon return to a state of nature, or perhaps defects will arise, which did not exist when the breed was in its natural state, unless the greatest attention is paid to the selection of the individuals who are to breed together.

We must observe the smallest tendency to imperfection in our stock, the moment it appears, so as to be able to counteract it, before it becomes a defect; as a ropedancer, to preserve his equilibrium, must collect the ballance, before it is gone too far, and then not by such a motion, as will incline it too much to the opposite side.

The breeder's success will depend entirely upon the degree in which he may happen to possess this particular talent.

Regard should not only be paid to the qualities apparent in animals, selected for breeding, but to those which have prevailed in the race from which they are descended, as they will always show themselves, sooner or later, in the progeny: it is for this reason that we should not breed from an animal, however excellent, unless we can ascertain it to be what is called *well bred;* that is, descended from a race of ancestors, who have, through several generations, possessed, in a high degree, the properties which it is our object to obtain.

The offspring of some animals is very unlike themselves; it is, therefore a good precaution, to try the young males with a few females, the quality of whose produce has been already ascertained: by this means we shall know the sort of stock they get, and the description of females to which they are the best adapted.

If a breed cannot be improved, or even continued in the degree of perfection at which is has already arrived, but by breeding from individuals, so selected as to correct each other's defects,

and by a judicious combination of their different properties, (a position, I believe, that will not be denied,) it follows that animals must degenerate, by being long bred from the same family, without the intermixture of any other blood, or from being what is technically called, *bred in-and-in.*

Mr. Bakewell, who certainly threw more light upon the art of breeding than any of his predecessors, was the first, I believe, who asserted that a cross was unnecessary, and that animals would not degenerate, by being *bred in-and-in*, which was at that time the received opinion.

He said, you could but breed from the best. Of this there can be no doubt; but it is to be proved, how long the same family, *bred in-and-in*, will continue to be the best.

No one can deny the ability of Mr. Bakewell, in the art of which he may fairly be said to have been the inventor: but the mystery with which he is well known to have carried on every part of his business, and the various means which he employed to mislead the public, induce me not to give that weight to his assertions which I should do to his real opinion, could it have been ascertained.

Mr. Meynell's fox-hounds are likewise quoted as an instance of the success of this practice: but, upon speaking to that gentleman upon that subject, I found that he did not attach the meaning that I do, to the term *in-and-in.* He said, that he frequently bred from the father and the daughter, and the mother and the son. This is not what I consider as breeding *in-and-in;* for the daughter is only half of the same blood as the father, and will probably partake, in a great degree, of the properties of the mother.

Mr. Meynell sometimes bred from brother and sister: this is certainly what may be called a *little close:* but should they both be very good, and, particularly, should the same defects not predominate in both, but the perfections of the one promise to correct in the produce the imperfections of the other, I do not think it objectionable: much further than this, the system of breeding from the same family cannot, in my opinion, be pursued with safety.

Mr. Bakewell had certainly the merit of destroying the absurd prejudice which formerly prevailed against breeding from animals between whom there was any degree of relationship: had this opinion been universally acted upon, no one could have been said to be possessed of a particular breed, good or bad; for the produce of one year would have been dissimilar to that of another, and we should have availed ourselves but little of an animal of superior merit that we might have had the good fortune to possess.

The authorities of Mr. Bakewell, and of Mr. Meynell, being generally quoted, when this subject is discussed, I have stated, why I reject that of the former altogether, and that the latter, in point of fact, never fairly tried the experiment.

I do not find that any of the many advocates for breeding *in-and-in*, with whom I have conversed, have tried it to any extent; they say, that it is to perfect animals only that the practice applies, but the existence of a perfect animal is an hypothesis I cannot admit.

I do not believe, that there ever did exist an animal without some defect, in constitution, in form, or in some other essential quality; a tendency, at least, to the same imperfection, generally prevails in different degrees in the same family. By breeding *in-and-in*, this defect, however small it may be at first, will increase in every succeeding generation; and will, at last, predominate to such a degree, as to render the breed of little value. Indeed, I have no doubt but that by this practice being continued, animals would, in course of time, degenerate to such a degree, as to become incapable of breeding at all.

The effect of *breeding in-and-in* may be accelerated, or retarded by selection, particularly in those animals who produce many young ones at a time. There may be families so nearly perfect, as to go through several generations, without sustaining much injury, from having been bred *in-and-in;* but a good judge would, upon examination, point out by what they must ultimately fail, as a mechanic would discover the weakest part of a machine, before it gave way.

Breeding *in-and-in*, will, of course, have the same effect in strengthening the good, as the bad properties, and may be beneficial, if not carried too far, particularly in fixing any variety which may be thought valuable.

I have tried many experiments, by breeding *in-and-in* upon dogs, fowls, and pigeons: the dogs became, from strong spaniels, weak and diminutive lap-dogs, the fowls became long in the legs, small in the body, and bad breeders.

There are a great many sorts of fancy-pigeons; each variety has some particular property, which constitutes its supposed value, and which the amateurs increase as much as possible, both by breeding *in-and-in*, and by selection, until the particular property is made to predominate to such a degree, in some of the most refined sorts, that they cannot exist without the greatest care, and are incapable of rearing their young, without the assistance of other pigeons, kept for that purpose.

The Leicestershire breeders of sheep have inherited the principles, as well as the stock, of their leader, Mr. Bakewell: he very properly considered a propensity to get fat, as the first quality in an animal, destined to be the food of man: his successors have carried this principle too far; their stock are become small in size, and tender, produce but little wool, and are bad breeders.

By selecting animals for one property only, the same effect will, in some degree, be produced, as by breeding *in-and-in:* we shall obtain animals, with the desired property in great perfection, but so deficient, in other respects, as to be upon the whole an unprofitable stock.

We should, therefore, endeavour to obtain all the properties that are essential to the animals we breed. The Leicestershire sheep prove that too much may be sacrificed, even to that most desirable quality in grazing stock—a disposition to get fat at an early age, and with a small quantity of food.

Many causes combine to prevent animals, in a state of nature, from degenerating; they are perpetually intermixing, and therefore do not feel the bad effects of breeding *in-and-in:* the perfections of some correct the imperfections of the others, and they

go on without any material alteration, except what arises from the effects of food and climate.

The greatest number of females will, of course, fall to the share of the most vigorous males; and the strongest individuals of both sexes, by driving away the weakest, will enjoy the best food, and the most favourable situations, for themselves and for their offspring.

A severe winter, or a scarcity of food, by destroying the weak and the unhealthy, has all the good effects of the most skilful selection. In cold and barren countries no animals can live to the age of maturity, but those who have strong constitutions; the weak and the unhealthy do not live to propagate their infirmities, as is too often the case with our domestic animals. To this I attribute the peculiar hardiness of the horses, cattle, and sheep, bred in mountainous countries, more than to their having been inured to the severity of the climate; for our domestic animals do not become more hardy by being exposed, when young, to cold and hunger: animals so treated will not, when arrived at the age of maturity, endure so much hardship as those who have been better kept in their infant state.

If one male, and one female only, of a valuable breed, could be obtained, the offspring should be separated, and placed in situations as dissimilar as possible; for animals kept together are all subjected to the effects of the same climate, of the same food, and of the same mode of treatment, and consequently to the same diseases, particularly to such as are infectious, which must accelerate the bad effects of *breeding in-and-in*.

By establishing the breed in different places, and by selecting, with a view to obtain different properties in these several colonies, we may perhaps be enabled to continue the breed for some time, without the intermixture of other blood.

If the original male and female were of different families, by breeding from the mother and the son, and again from the male produce and the mother, and from the father and the daughter in the same way, two families sufficiently distinct might be obtained; for the son is only half of the father's blood, and the pro-

duce from the mother and the son will be six parts of the mother and two of the father.

Although I believe the occasional intermixture of different families to be necessary, I do not, by any means, approve of mixing two distinct breeds, with the view of uniting the valuable properties of both: this experiment has been frequently tried by others, as well as by myself, but has, I believe, never succeeded. The first cross frequently produces a tolerable animal, but it is a breed that cannot be continued.

If it were possible, by a cross between the new Leicester and Merino breeds of sheep, to produce an animal uniting the excellencies of both, that is, the carcase of the one with the fleece of the other, even such an animal so produced would be of little value to the breeder; a race of the same description could not be perpetuated; and no dependance could be placed upon the produce of such animals: they would be mongrels, some like the new Leicester, some like the Merino, and most of them with the faults of both.*

I have no doubt but that better stock may be obtained, in a few years, in this manner, from a large flock of well-chosen ewes, than by breeding, at first, from a small number of the pure Merino blood, (and many of them cannot be obtained;) for the great advantage to be derived from the means of selection afforded by a more numerous flock, will more than compensate for the little stain of impure blood, which would be insensible in a flock, crossed in this manner, for four or five generations.

The introduction of Merino sheep to this country opens a fine field for improvement: it has been ascertained, that neither the sheep nor the wool sustain any injury from the change of climate or pasture; and the absurd prejudice, that Merino wool could be grown only in Spain, is fortunately eradicated.

It is well known, that a particular formation generally indicates a disposition to get fat, in all sorts of animals: but this

* As this experiment has been made by myself and others in the United States, time will show the correctness of the above opinion—Editor.

rule is not universal, for we sometimes see animals of the most approved forms, who are *slow feeders*, and whose flesh is of a bad quality, which the graziers easily ascertain by the *touch*.—The disposition to get fat is more generally found in some breeds than in others. The Scotch Highland cattle are remarkable for being almost all *quick feeders*, although many of them are defective in shape. The Welsh cattle have but little disposition to fat; not from being particularly ill-shaped, but because they are almost invariably what the graziers call *bad handlers*.

I have always found the fineness of the fleece in exact proportion to the quantity of yolk it contained. Those who are unaccustomed to examine wool, may consider this as a certain criterion of its quality: for although the hair of some dry fleeces may be fine, it will always want the elasticity which is so much valued by the manufacturer.

It is to be regretted, that so little attention has been paid to the improvement of British wool, and particularly to that of the short-woolled breeds: a fine fleece is not only more profitable to the owner, but from the closeness of its texture, and the quantity of yolk it always contains, is a much better protection to the sheep in bad weather, than the open and hairy covering, which too generally disgrace our flocks. [I beg that the American farmer will attend to this hint—Editor.]

The fineness of the fleece, like every other property in animals of all kinds, may be improved by selection in breeding. The opinion, that good wool could only be produced in particular districts, is a prejudice which fortunately no longer exists.

Climate, food, and soil, have certainly some effect upon the quality of wool, but not so much as is generally supposed. The fleece is affected by the degree of nourishment which the animal receives, not by the quality of the pasture on which it is fed. If sheep are highly kept, the wool will be less fine,* but in other respects its flesh will not be deteriorated. The wool of a starved

* It is now established, that this remark does not apply to the Merino breed.—Editor.

sheep may be apparently fine, but it will be brittle, and of little value to the manufacturer.

A regular supply of food to the sheep is essential to the growth of good wool, for that part of the hair which grows when the animal is in a high state of flesh, will be thick, and that which is grown when it is reduced by hunger, will be weak and thin; and consequently the thickness of hair will always be irregular, if the animal passes from one extreme to the other.

The alteration which may be made in any breed of animals by selection, can hardly be conceived by those who have not paid some attention to this subject; they attribute every improvement to a cross, when it is merely the effect of judicious selection."

Upon the contested point of the size of cattle, it may be proper to say something on the present occasion.—Even keeping the grand object of all farmers and graziers, in view, viz. profit, the only consideration would seem to be, what variety of any particular breed of cattle will soonest make the most profit, or return of flesh or fleece from a given quantity of food. It follows therefore clearly, that if the same quantity of food be placed on one animal or on three, in a given time the profit to the farmer is the same. In the case of sheep, the superior value of the fleece may even more than compensate for a deficiency of flesh, were that an object of prime attention, but it is a fact, as has been more than once stated, that even in respect to flesh the Merino breed is inferior to none. Without detailing the arguments which might be urged on both sides of the question, we may say generally, that the result of several experiments made in direct reference to the point, was in favour of the superior profit of smaller animals.* Much more however will certainly depend upon the

* These experiments were made by the late Duke of Bedford, and the result inserted in the 23d and 26th Vols. of Young's annals of agriculture.—Those of Mr. Billingsley, and Mr. Davis, both well known as good farmers, are related in the 7th and 8th Vols. of the Memoirs of the Bath Society. See also Dr. Parry's prize essay on sheep, in "Communications to the Board of Agriculture of London," Vol. V. p. 461.

disposition of the animal to take on fat, than upon his size, and hence the great importance of attending to the improvement of form is made manifest. In the case of sheep, it will be seen by the communication* in this number, that those of a small size are more profitable feeders than the larger species. Both large and small cattle however are necessary; the former for long voyages, the latter for home consumption, and the judicious farmer will always of course suit his stock to his pasture, or to the particular situation or circumstances in which he may be placed. Thus on upland, if the farmer feeds on clover and has not the excellent green grass, or spear grass as it is sometimes called, (*Poa Viridis*,) it is a folly to attempt to feed cattle above 6 or 700 Cwt. for the frost will destroy his grass, and then corn, potatoes and hay must be resorted to. In the luxuriant meadows on Delaware and Schuylkill, owing to the abundance of that most excellent natural production of the United States, just mentioned, cattle will continue to thrive a full month after frost, and then, if destined for long voyages, corn meal for a short time will pay well; but as usually given, a loss will inevitably be sustained.

AMERICAN CATTLE.

NO slander against the United States has been more widely circulated than that first promulgated by the Count Buffon, that "all animals and vegetables are smaller in the new world than in the old." We owe the first refutation of this absurdity to Mr. Jefferson, who in his "Notes on Virginia," has by a fair comparison of the productions of both countries, shown, that so far from the fact being as stated by Buffon, the advantage is on our side. The facts stated by Mr. Jefferson, were all derived from the production of our forests, and numerous others might be added of a similar nature. But with respect to the effect of cultivation on domestic animals, no collection of facts has as yet been made public, and for this reason the following paper is given. It will

* By Mr. Birkbeck.

show to the world, that our grasses contain as much nourishment, and that our climate is as favourable as that of the old world, to the rearing of stock. Great pains have been taken so insure accuracy in the details.

Account of large Cattle, Hogs, and Sheep, chiefly sold in the Philadelphia Market.

1. A Cow raised by the late Jacob Hiltzheimer of Philadelphia, and sold February 28th, 1787.

The fore quarters weighed - -		654 lbs,
hind do. - - - -		571
		1225
Hide weighed - - -	111 lbs.	
Head and heart, - -	49	
Belly and feet, - -	72	
Tallow, - - -	163	

2. A five year old Steer, fed by Lawrence Sickle, Esq. of Philadelphia, one summer and winter.

Beef, - - -	1494¾ lbs.
The belly fat, - -	278½
Kidney do. - - -	100

3. Ten head of cattle fed by the same gentleman, produced 2,439 lbs. of belly and kidney fat, with one summer's feeding.

4. A Steer raised at Haddonfield, New Jersey, and killed at Philadelphia, April 1787, weighed alive, 2,140 lbs.

5. In June 1802, an ox was exhibited in New York; he was seven years old, and weighed upwards of 3000 lbs. net. He was twenty hands high, at the withers. His circumference around the ribs was ten feet, and the distance from the tip of his nose to the extremity of tail was 18 feet. He was raised in Beekmantown, Dutchess County, New York, by Theod. VanWyck.

6. An ox full as large as the above, was exhibited at Washington, in March 1804. He was six years old, and also weighed 3000 lbs. He was raised in Chester County, Pennsylvania.

7. An Ox fatted by James Hunt, of Hopewell, New Jersey, in 1807—weighed alive, - - - 2120 lbs.

Weight of beef, - - -	1280
Rough tallow, - - -	214
Hide, - - - - -	121

8. A Heifer raised by Wm. West of Upper Darby, Delaware County, Pennsylvania, sold for 200 dollars to J. Barney.

Killed, March 1806.	Ft.	In.		
Length,	8	9	Live weight,	2135 lbs.
Height, - -	5	7	Beef -	1303½
Girth, - - -	8	9	Rough tallow,	124½
Across the Hips,	2	9	Hide, -	124

A Steer, raised at Tulpehocken, Lancaster County, was killed on the 12th of March, 1807, weighed alive, 2,140 lbs.

9. A Steer raised by T. Smith, of Tinicum Island, Delaware Co. nearly 6 years old, killed March 26th, 1808, and sold for 250 dollars to John Barney.

	Ft.	In.	
Length, -	8	11	
Height, -	5	6	
Girth, -	8	11	
Across the hips,	2	8	
Live weight, - - -			2450 lbs.
Beef, - - -			1576
Tallow, - - -			203
Hide, - - - -			130

10. Two Oxen fed by Joseph Taylor, of Brandywine, near West Chester, weighed alive, 4,368 lbs. Sold to J. Barney.

11. A Cow fed by L. Sickle, aged five years, killed April 7th 1808.

Weighed alive,	2226 lbs.
Weight of beef,	1394½
Rough tallow,	209½
Hide,	130

12. Weight of two Steers fed by William Sheaff.

Live weight,	2436—2422 lbs.
Beef,	1554—1543¾

13. An Ox fed by Mr. Grub, West Chester, about 4 years since.

Live weight,	2128
Beef,	1312
Tallow,	192

14. A Steer 6 years old, from a Holland Cow, by an English Bull, raised from 4 weeks old, by Mr. Wm. Guier, of Philadelphia, killed March 9th, 1808.

Live weight,	2,387 lbs.
Four quarters,	1,548¼
Hide,	117
Tallow,	173

Measurement.	Ft.	In.
Girth, back of fore legs,	8	7
——, of neck,	3	11
Length from back of horn to point of rump,	8	8
Height over withers,	5	5
—— over rump,	5	6¼

Another Steer fed by Mr. Wm. Guier, weighed alive 2394 lbs.

Beef,	1529¾

15. Weights of a Milch Cow, raised by Jacob Hiltzheimer, fed by Mr. David Sickle, killed by G. Hopple, jun. March 30th 1799, 6 years old.

Fore quarters,	791 lbs.
Hind do.	595⅓
	1386⅓ lbs.
Tallow,	187
Hide,	166
	1,739

16. Dec. 1806.—Cow and Calf—grazed by D. Sickle. Cow 4 years old.—Calf 1 year and 10 months old.

Beef,	1002 lbs.
Calf,	778
Tallow of Cow,	177
do. of Calf,	84
Suet of Cow,	114
do. of Calf,	67

17. A Steer not four years old, and an Ox, grazed by W. Stanley, killed by G. Hopple.

Beef of Steer,	1402 lbs.
Tallow,	156
Beef of Ox,	1476
Tallow,	183

18. Ox raised by Mr. Mower, of Lancaster County, grazed and fed by Lawrence Sickle, Esq. killed by Tallman and Miller, April 5, 1810.

	Ft.	In.
Girth behind the shoulders,	6	8¼
—— round the neck,	3	11
—— round the loins,	9	0
—— below the knee,		9½

	Ft.	In.
Height over the feet,	5	4
——— over the hips,	5	6
Width across the hips,	2	5
Length of carcase,	9	
Weight of forequarters,	952¼ lbs.	
Hind do.	714¾	
	1667¼	
Tallow,	234	
Hide,	125	

The make of the above Ox, was uncommonly fine for so large an animal.

19. A Steer 6 years old, raised and fed by Samuel Tomkins, of New Jersey, and killed by Tallman and Miller, March 1810.

Beef,	1488½ lbs.
Tallow,	326
Suet,	140

20. Two Steers 6 years old, raised and fed by E. Bissel, of East Windsor, Connecticut, and killed by D. Woelfper and Co. February 2d, 1811, of Philadelphia.

No. 1.

Fore quarters,	928 lbs.
Hind do.	647¼
Hide,	125½
Tallow,	107

No. 2.

Fore quarters,	919 lbs.
Hind do.	638½
Hide,	125
Tallow,	146

21. A bullock 7 years old, raised in Morris County New Jersey, by Mr. Blanchard, and fed by Mr. M. Dubs, of Philadelphia.

Live weight,	2842 lbs.
2 Hind quarters,	815¾ lbs.
2 Fore quarters,	1201¾
	2017½
Rough tallow,	188
Hide,	145

	Ft.	In.
Height,	5	10*
Across the brisket clear of bone,		9
Through the plate and brisket,		10½
Clear fat on the rib,		5½
On the surloin,		4
On the rump,		3½
On the back clear of bone,		3½

Sold to J. Moore, and Wm. Warner, and slaughtered by them, March 20th, 1811.—Price 1000 dolls.

Hide sold for	$10
Tongue,	5
Paunch,	3

22. In April 1809, was exhibited in Boston, an Ox, whose 4 quarters weighed, 1758 lbs.

Hide,	128
Tallow,	247
Total,	2133

23. Thirty-six Hogs raised and killed by Francis Shinn of New Egypt, weighed, 12,627 lbs.

The largest hog weighed	474
The smallest weighed,	297

The oldest hog did not exceed 18 months, and the youngest 10 months. The amount of the Pork was $1,136 43.

* At the Cattle Show, April, 1810, he was 5 feet 7 and a half inches high.

24. A Hog 18 months old, raised by Mr. Ashbridge, in Chester County Pennsylvania, and killed March 1807, by A. and D. Lex, Philadelphia, weighed 654 lbs.

25. Several Hogs as large, and two larger, have been killed in Philadelphia, within the last four years.

ON THE COMPARATIVE PROFITS OF WILTSHIRE AND MERINO-CROSS SHEEP.

The following statement by a well known British farmer, will show the propriety of the Merino Cross, over a favourite species of sheep in England; and will also afford an example of the mode of conducting a feeding experiment with accuracy. The prices are in Sterling: the stone 8 lbs.—*Editor.*

To the Editor of the Agricultural Magazine, London.

SIR,

I BEG the favour of you to insert the following calculations and remarks respecting two pens of sheep, which I exhibited at Lord Somerville's Spring show in Goswell-street, on the 5th and 6th inst. viz.

FIVE WILTSHIRE WETHERS.

		£.	s.	d.
Live-weight Nov. 30, 1809 -	817 lb.			
——— March 2, 1810 - -	999 lb.			
Increase in 13 weeks, - -	182 lb. at 8d. per lb.	6	1	4
Growth of wool in ditto, - - -		0	8	9
Increased value, - - -		6	10	1

Food Consumed.

	cwt.	qr.	lb.		£.	s.	d.	
Turnips,	43	1	6¼	at per acre £4. 10s.	1	2	6	
Hay,	19	2	18	at £5. per ton, -	4	18	4	
Oil-cake,	100			at 4d. -	1	13	4	
Cost of Food, - -								7 14 2
Loss at the above prices, -								1 4 1

Five and three quarter Merino Wethers.

		£.	s.	d.
Live-weight, Nov. 30, 1809	537 lb.			
——— March 2, 1810	670 lb.			
Increase in 13 weeks,	133 lb. at 8d.	4	8	4
Growth of wool in do.		1	5	0
Increased value.		5	13	4

Food Consumed.

	cwt.	qr.	lb.		£.	s.	d.
Turnips,	21	1	20	nearly ¼ of an acre	0	11	0
Hay,	10	3	2	at £5.	2	13	10
Oil-cake,	100	0	0	at 4d.	1	13	4
Cost of Food,					4	18	2
Profit,					0	15	2

It appears from this experiment, that the food which was consumed by the large sheep, would have produced 14 per cent. more in absolute weight of mutton, if consumed by the small sheep; there is also a difference of more than 1d. per lb. in the value of the mutton, which is 12½ per cent. besides 400 per cent. in wool.

N. B. These sheep were sold to Mr. King, of Newgate Market, March 5th, the large sheep at 5*s*. 8*d*. the small at 7*s*. per stone.

MORRIS BIRKBECK.

Wanborough, near Guilford, Surrey, March 6, 1810.

ERRORS OF THE SUPPOSED

SPANISH SHEPHERD CORRECTED.

AMONG the numerous absurd publications on the subject of Merino Sheep, which have appeared in the public papers of the United States, the following stands conspicuous. From its having been given as the result of the experience of a Spanish shepherd, much weight is unfortunately attached to it, and I am sorry to learn, that the frightful picture it holds up, has had the effect of discouraging many of our farmers from attempting to introduce Merinos on their farms. To give high prices for a breed of sheep so subject to disease as the Merinos are here represented to be, and that require a degree of care, so much greater than nine out of ten of the American farmers have it in their power to bestow, would be reasons sufficiently strong to prevent the general introduction of that invaluable breed among us. But I hope to convince them of the little attention the paper merits. Indeed I doubt whether it is the production of a shepherd, for we know that the ignorance of that class of mankind is in the extreme, and that very few, if any, ever learn to read or write. I am induced to believe that the paper in question was written by a Spanish gentleman, in whose company I came in the Steam Boat from New York to New Brunswick, in October last; for another passenger who conversed with him, informed me, that he (the Spaniard,) had left a paper on the subject in Boston, with a friend who had requested it, and as only one paper of the kind has appeared, I think it highly probable, that the following remarks are those he alluded to. The Spanish gentleman was said to be a lawyer, and may have had a theoretical knowledge of the diseases of sheep; and even granting that what is said in his paper is true as applied to Spain, I aver that the alarming parts of it, apply but feebly to this country.—*Editor.*

From the Boston Chronicle.

MESSRS. EDITORS—Having requested the Spanish Shepherd, whilst he staid in this town, to favour me in writing with all he knew and could recollect respecting the nature and management of the Merino sheep, with a view to render it public for the good of the country, I have received a really pastoral communication on the subject, which having translated literally, I presume you will, from patriotic motives, readily give it a place in your paper. B.

Chelsea, 13th Oct. 1810.

SIR—Experience is very necessary and advantageous for the government and attendance of the Merino sheep, that have been brought into this country from the kingdom of Spain.

1st. The dryest pastures and grass that can be found should be given them, guarding them from wet and damp places.

2d. When the weather is fair and clear, they should not be turned out until the dew is perfectly dry.

3d. They should be kept with great care from every standing or stagnant water, that has no current, and soap-suds are very pernicious.

4th. They should be carefully guarded from thunder and hail-storms; they should not graze then or drink of that water, waiting till the rain and hail moisture has disappeared, for this is very injurious to said sheep. The salt should be given them in the morning and in the evening, keeping them from drinking till three or four hours after; the salt in this country being different from that used in Spain, should be given sparingly till they are used to it; there it is of a red colour and from a pit, and here it is white, which is not so beneficial for the feeble sheep.

5th. This kind of sheep is very subject to have the scab, and it often makes its appearance from night to morning, and requires a constant attention to cure it—The best remedy is juniper oil; a decoction of black tobacco leaf is also good; but when the latter is used it is necessary that the weather should be dry, for if it should rain it would spread the more. The fourth part of a

pound of tobacco should be put in a kettle with ten or twelve pints of water, and after it shall have been boiled, the scab must be well rubbed with it in a luke-warm and not hot state, otherwise the wool would be injured.

6th. For the disorder called *basquilla*, (disease in sheep arising from a plenitude of blood) bleeding in the belly, on the fore part of the dug in a vein which they have there, is good.

7th. If any should swell in their belly, they should be bled under the corner of the left eye.

8th. For the disease of the spleen they should be pricked with an awl in the spleen, which is found by leaving three ribs behind and four fingers below the back bone. *This disorder of the spleen is very injurious; as for instance, if a sheep should die with it that wears a small bell, and this should afterwards be put on another, it will also die.* These their disorders proceed from too great an abundance of clear fresh grass; shepherds should be particularly attentive on this point.

9th. The small pox makes its first appearance by blisters or tumors on the flanks or hinder part of the sides, and then it spreads by degrees all over. It is necessary to separate the infected from the sound, so that they may neither lodge nor graze together; for one sick sheep is enough to infect all the rest. This disease proceeds from drinking standing water, and it is necessary to let it have its course, taking care to examine them often, and as soon as the pustules are broken, to anoint the same with sweet oil.

10th. In the disorder called *moderrez* (lethargy) they turn round as they are grazing. This arises from blisters that are forming in their brain, and they turn on that side where pustules grow. Very few recover from this disease, which is contagious. Some get well by pricking with an awl the affected part, and drawing the water, but they generally remain imperfect, and it is therefore better to kill those that have that disorder.

11th. Lameness—If it should be found that the foot is swollen and that it has matter, the points of the nails should be broken off until it bleeds; should it be perceived that its pera (a small

tuft of hair between the two nails, is swollen, it should be drawn out with a needle and cut around with a knife, pulling until it comes out: by this means it will heal much sooner than if it were burst.

12th. The horns of the rams are cut off in Spain for two reasons; the first is to avoid their striking one another with them in the season of generating; and the second is that it may serve them instead of bleeding in the spring, at which season it is executed, choosing fair and warm weather for this operation. This is the manner in which it is done:—A hole is made in the ground, the ram is put in it with his legs upwards, and a board on his head to which the horn is well fitted; then a knife made for that purpose is fixed against the horn level with the head, and is cut off with two blows struck with a hammer. This operation is performed every year with only those that are preserved for propagation, and are distinguished by the name of Moruecos (ram, or male sheep.)

13th. It is customary in Spain, to allow two ewes to one lamb, that they may soon get strong and be able to resist the inclemency of the weather, and it should be studied that they come into the world in a fine season; they ought to have a dry litter, and when they are turned out to graze, it should be in a sunny place free from any water. The disorders to which the lambs are liable, are the following:—The *Lobanillo* (wen, ganglion) in which their kidneys swell. The *Amarilla* (jaundice) in which their flesh and bones turn of the colour of yellow wax; this disorder is infectious; throwing a small quantity of *Torvisco* (flaxleaved daphne, (daphne gnidum) is good for this complaint. The *Covino* (curb) they are lame in their feet; if these should swell, it is good to an oint them with juniper or sweet oil.—All these disorders proceed from damp and wet weather when they are brought forth; and are besides subject to all the complaints of the ewes, for which the same remedies before-stated must be observed.

14th. The tails of these sheep are cut off because it is the custom, and because if they should have the disorder called *Chamberga* (diarrhoea) the dirt they would collect in the wool of the

tail would be considerable, and would certainly spoil the remainder with it.—This operation is performed when they are two months old, with a very sharp knife, cutting away the wool around it with a pair of scissars to prevent its sticking to the wound, choosing for this purpose warm and fine weather.

It is very necessary and advantageous to observe attentively all things before stated, if one wishes to avoid considerable loss in this kind of sheep.

God preserve you many years.

(Signed) **PHILIP DE CASTRO.**

A native of the mountains of Leon, in Spain.

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REMARKS.

The first caution, respecting the necessity of dry pastures is known to all farmers, as applicable to *every species* of sheep.

The second caution, respecting the propriety of not turning out the sheep, before the dew is exhaled, does not apply in the United States, nor in England: In neither of which has it been found in the least injurious. I can myself speak positively and experimentally on the subject. Mr. Livingston,* has clearly shown, that the prejudice concerning the dews, originated in the wishes of the shepherds, to abridge as much as possible, the trouble of attendance on their flocks: for their laziness is proverbial, so that while the poor animals were starving in the fold, they themselves might indulge in sleep.

Third, water whether current or stagnant, is alike injurious, if sheep be much exposed to it. The caution about soap suds was useless, for they can never be exposed to the danger of standing in them, nor can I see why suds should prove injurious.—Would they not cleanse their feet? I have myself often used soap to wash the clefts of their hoofs, when affected by soreness, previously to the application of a remedy to cure it.

* His work (of which a second edition has been published), should be in the hands of every farmer.

My sheep were never sheltered, on account of thunder storms, and they did not suffer. Hail storms occur but seldom in Pennsylvania; it would certainly be well to put sheep under cover in a hail storm, for their eyes might be put out, and the lambs killed, if the stones were large; but to suppose that the hail-moisture or rain that falls in a thunder-storm are specifically injurious, is like the prejudice about *dew*, absurd. I never used any salt for my sheep except white salt, and this was given them when convenient, generally once a week throughout the year, some times in the field, and at other times in the sheep house. The red salt mentioned, is as hard as a stone, and derives its hue from iron; and there is no reason for supposing that it possesses superior medicinal qualities.

Fifth. I deny positively, that Merinos are particularly liable to the scab, when properly treated. I have never had the scab in my flock. The Merinos imported into the United States during the past year have been much afflicted by it, owing to the great fatigue they underwent before they were shipped, and to want of cleanliness, of ventilation, and to the scanty food while on shipboard. Juniper oil is not better than spirits of turpentine, or tobacco water, for the scab, or other remedies, and is far more expensive.

Sixth. Blood taken from any part of the body will answer as well as from the dug vein. Pasture less rich should be afterwards chosen.

Seventh. The last remark will apply here; a wine glass full of castor oil should be given when the body swells.

Eighth. I do not know the symptoms of diseased spleen in sheep, and do not find it mentioned in any of the many treatises on sheep which we have. The notion of this affection being propagated by a sheep wearing the bell of one that died of it, is about as reasonable as the story gravely told by an old medical writer in Germany, of a dog catching the gout from sleeping at the feet of his gouty master!!!

Ninth. It is a fact that Merinos recently imported into this country, have had a disease very much resembling the small pox;

but we know nothing of it among those that arrived here before, or that descended from them. When it appears however, it must be attended to, or it will kill. The directions to separate the diseased from the healthy, are judicious: but the sick sheep should also be purged, and the pustules opened by a lancet, and cleanliness observed.—If the disease appear partially, the wool should be plucked out from the part.

Eleventh. A careful farmer will never permit a disease in the foot to proceed to such a height: if matter is formed, let it be opened by a lancet: do not touch the nails unless they require paring, and then use a knife.

I repeat—Merino sheep when well treated, are a healthy race.

FACTS *concerning the* SLABBERING DISTEMPER *in* HORSES, *and other* DOMESTIC ANIMALS: *In a letter from* THOMAS MOORE, *of Montgomery County, (Maryland), Farmer to Dr.* MITCHILL, *dated Brookville, 22d Feb.* 1805.*

AGREEABLY to thy request, I shall endeavour to give a concise history of the slavering disease of horses, kine, sheep and hogs, which has, for some time, existed in this country, conformably to the facts which have come under my observation.

Late in the summer of 1795, I was told that the grass from a certain lot in the neighbourhood produced a remarkable defluxion of saliva from the mouths of horses. Soon after harvest, in the year 1796, I discovered something of it on my own farm, and was told that it had appeared on several others. In the course of a year or two more, it became general throughout the neighbourhood, gradually increasing in its effects, and beginning earlier in the season every succeeding year, until about the year 1802, since when it appears to be nearly stationary. It now commences about the last of the fifth month, and continues through the summer and autumn. It was not discovered for some years that any other animals than horses were affected by it, nor was their health supposed to be materially injured; but at length,

* Medical Repository, Hexade 2, Vol. 3, p. 24.

kine, sheep, and hogs began to be sensibly affected, and it was found that horses would *actually die* if confined to the grass of certain fields without any other food.

The calamity now assuming a serious aspect, my attention (as well as many others) was turned towards a discovery of the *cause*, in hopes of being thereby enabled to take such measures as would lessen the *effects*. Red clover being the grass most commonly used for green food on many farms, an opinion very early prevailed, that the introduction of *this grass* had produced the disease. To this opinion, however, I could not subscribe, having frequently observed that the disease was produced in as great a degree by the grass of some fields where there was not a plant of clover to be seen as by any other; and, on the contrary, I found, by inquiry, that the disease was then unknown in several parts of Pennsylvania where red clover had been much longer in use than with us. But from observing that a small hard-stemmed grass generally made its appearance about the time the disease began, I (with many others) was led to believe that this grass was the cause; and, in order to ascertain it, made the following experiments: I picked over about seven pounds of red clover so carefully that I knew there was not a blade of any other kind of grass amongst it, and gave it to an hungry mare, entirely free from disease. In one hour after eating it, I was surprised and disappointed, by finding the disease to be excited in a considerable degree. The mare was then kept on dry food until she was again freed from disease, and an experiment made on the small grass before spoken of, the result of which was the same. Similar experiments were afterwards made on several other kinds of upland grass, and always with the same result. We also find, that any kind of grass which will produce the disease in its green state, will produce nearly the same effects when dry. In the course of the last two years it has become general throughout a district of country of some hundred miles in extent: and although I have yet heard of but few places where other animals than horses are materially affected by it, yet, from the increasing effect on them, and the rapid spread of the disease, it is to be apprehended, that

the time is fast approaching when it may be considered among the most serious calamities with which this country has been visited.

The symptoms in horses are a constant discharge of a watery fluid from the mouth, (probably to the amount of several gallons in twenty-four hours) without any apparent inflammation of the salivary glands; great thrist, dulness, loss of flesh, always exhibiting the same sunken appearance in the flank as an animal that is almost famishing for food: after some continuance of these symptoms, comes on a stiffness in all the limbs, which altogether continue till death. In other animals the symptoms appear to be nearly similar, though less in degree. Milch cows suffer a considerable diminution in the quantity of their milk, and still greater in quality, so that the profits of the dairy are much lessened. Dry cattle require a much longer time to fatten; and indeed, on some grounds, can scarcely be fattened at all. Hogs are not perceivably benefited by any grass which produces the disease in considerable degree. Sheep do not suffer as great inconvenience from it as any of the three last mentioned animals, yet they are sometimes very sensibly affected.

From some late observations I am inclined to believe, that if hay be put in bulk in such an uncured state as to cause it to pass through a very strong heat, the pernicious effect will be nearly destroyed; and if on further trial this proves to be the fact, may it not, in conjunction with the two following, to wit, that the disease is confined to uplands, and that ploughing generally eradicates it for at least a year (being always worst on grounds which have lain long in grass), afford something like a clue to unravel the mystery? Low grounds being, as far as we know, entirely exempt, looks like the exercise of animal instinct in regard to situation: and the effect of the plough to remove the cause for a short time, and the same afterwards gradually increasing, favours the supposition of the existence of an *insect* which may in some way produce the disease: perhaps by either an *excrementitious* or *ovarious* deposition on the grass, the qualities of which (particularly if ovarious) would probably be much chang-

ed by the degree of heat before mentioned. But I do not believe that any such deposition has *yet* been discovered.

I remember, in one instance, to have observed a reddish appearance produced where the clover from a horse's mouth was dropped on purple cloth; hence may be inferred the presence of an acid of some kind.

In the foregoing statement I have related the facts nearly as they came under my own observation, with respect to the order of time; but, on conversing with some old observing men, I find the disease is not *entirely new*, but that the second cutting of grass, in several places, has for many years been known to produce the disease in a very slight degree; yet so inconsiderable as not to excite serious attention.

These are the principal facts which have come to my knowledge relative to this extraordinary disease; and these, I hope, will be sufficient *to insure the subject a scientific investigation;* for surely that man will deserve well of his country, who, *by developing the cause*, will aid us in our endeavours to overcome the calamitous effects.

THE salivation, in animals, particularly in horses, from eating second crop grass, especially red clover, is an effect well known and lamented in the state of Pennsylvania, and in some other states: whether in all is uncertain. I have been at some pains to ascertain the epoch of its appearance, but I am sorry to say, that my inquiries have been attended with little success.—Thus much is certain, that it appeared in different parts of Pennsylvania, at various times; hence while some farmers have mentioned 15 years, others have said that it did not appear on their farms until 10—8—5 years past.

In the county of Montgomery, state of Maryland, it was noticed by Thomas Moore, as stated in his paper, for the first time in 1795. Others had remarked it before. A gentleman informed me, that he well remembered to have seen it in 1779, in horses pasturing on State Island, below Philadelphia. Mr.

Samuel Preston of Stockport, Wayne county, Pennsylvania, first observed it about six years ago.*—At first it was ascribed to the Gypsum, which was strewed early in the spring on the clover; but this theory cannot be correct, because second crops of other kinds of grass will salivate equally with clover, although they never were plastered. This I have had full opportunity of knowing, and the fact is agreeable to the observations of several others whom I have questioned as to the point. Timothy grass will have the effect, but not to the extent of clover; even green grass in some years is not free from the bad quality. It was also supposed to be confined to second crop red clover, but the fact just mentioned, with that stated by Thomas Moore, viz. that the disease was unknown in certain parts of Pennsylvania, where red clover had been much longer in use than in his neighbourhood, fully refute this opinion. On the other hand, Mr. Preston says, he has observed the disease to travel with the cultivation of clover, but this only proves that the disease is in some way connected with the cultivation of that plant. Mr. Preston remarks, that white frost puts a stop to the complaint, and hence he concludes that frost kills some plant which he supposes is the cause of the disease. It prevails in some seasons with much more violence than in others: last summer was remarkably cold and wet, and his horses had the disorder worse than ever: it not only reduced their flesh, strength and spirits, but rendered them incapable of service; they were therefore stabled and fed on dry hay. One young horse was neglected by not being put up, and died from the effects of the salivation. In a former letter however, he remarks, that "he knows of no change in the quality of his pasture during the time the disease continued," neither, says he, "do I know how to impute it altogether to the wet seasons, as we have had more or less of it for several seasons." This fact is conformable to my own experience, and that of others whom I have consulted.

In a communication on this subject by Dr. Perlee, of Wilming-

* Letter to the Author.

ton, Delaware, to the Agricultural Society of Philadelphia,* the disease is ascribed to the spotted spurge, the *Euphorbia maculata* of Linnæus, which grows with the clover, and flowers, about the same time as the second crop of clover.

He gave a horse a small quantity of spurge carefully gathered stem by stem, and perfectly free from all other vegetables, or any extraneous matter. A preternatural discharge of saliva took place in less than half an hour. This experiment was frequently repeated, and invariably with the same result. To prove that clover did not contribute towards it, in some cases, other grass was used as an envelope with the same effect. And when the horse was perfectly free from ptyalism, a considerable quantity of clover, gathered without *Euphorbia*, was given to him, and no such effect was produced. But this does not prove that the spurge is alone in fault, for Thomas Moore found that clover carefully picked produced the same effect: and a botanical friend who knows Euphorbia well, assures me he examined a field belonging to himself with great accuracy, without finding a plant of that genus in it, and yet a horse in the field, was slabbering profusely.

On a recent discussion of the subject at the Agricultural Society, a member mentioned, that a labourer, who in stacking a second crop of clover, had his arms, which were bare, covered with very small insects from the hay, said that they were the cause of the salivation in horses. He ascribed the effect to the acidity of the insect. Thomas Moore's fact of the change produced on a purple cloth by the saliva of a horse, supports the opinion.

There is certainly something very disagreeable to cattle in second crop clover hay. They do not relish it, and even in some cases refuse it. Mr. John Lorain of Philadelphia county, bought some cattle in the autumn of 1809, and found that after his corn stalks and stubble hay had been consumed, they in general refused second crop clover, although it had been well got in, and salted: a few eat it sparingly, and after some time they fell away in flesh, and in 21 days, during which time he tried to induce them

* See Memoirs Agricultural Society, Philad. Vol. 2.

to eat the clover, they began to scour, and were worth $200 less than when they began on it. He then mixed equal parts of green grass hay *(Poa Viridis)* and second crop clover, and found that they eat it more readily, but that they still did not relish the mixture. Mr. Lorain had previously given to the cattle corn fodder, but discovered that it was strongly disliked at first even by those which had eaten it readily the year before, as well as by the new cattle,* and that they preferred the old thatch on the sheds, and dry leaves in the barn yard, until they had been fed on about one acre of fodder, from corn planted in July for boiling or roasting ears; which being very succulent was eaten greedily, and after it was all consumed, they showed no dislike to the other.

Method of preventing the Accidents which frequently happen from the Linch Pins of Carriages breaking or coming out, by Mr. J. Varty, coach-maker, Liverpool. From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. The Silver Medal was voted to Mr. Varty for this Invention.

HEREWITH the Society will receive a model of an axle-tree for public machines, intended to prevent the wheel from coming off if the linch-pin should break, and thereby prevent many dangerous consequences. When the idea first suggested itself to me, I put it in practice in a stage-coach, which has since run from Liverpool to Litchfield, a distance of eighty-four miles, six days *per* week, for the last six months. During that time several instances have occurred in which the linch-pins have broke or come out, but owing to this contrivance no accident has happened therefrom. We almost daily hear of stage-coaches being upset, which more frequently arises from linch-pins breaking than from any other cause.

* This fact cannot be accounted for: as it is well known, that cattle are commonly very fond of corn fodder—Editor.

Certificates were received from Liverpool from several persons, who declared that they have witnessed many very melancholy accidents happening to passengers in stage-coaches, in consequence of the linch-pin breaking made in the common way, and from which some of them have been sufferers; but that they have never seen or heard of any such accidents where Mr. Varty's invention was made use of, though several of his linch-pins have broke.

FIGURE 1.

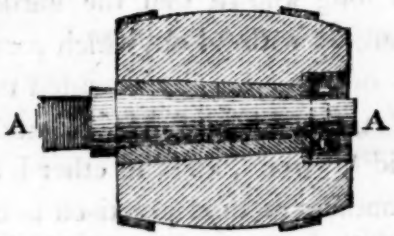

FIGURE 2.

REFERENCES.

Fig. 1, is a section of the nave of a carriage wheel, with the axletree AA in it; and Fig. 2, is a separate view of the axletree. *a*, Fig. 2, is the linch-pin detached; it is put through an oblong hole in the axle as usual, but there is likewise an additional linch-pin *b*, to make it complete, which is fixed in a recess cut for it in the axle, and turns on a pin (as is shown in the figure) into the hole left, by removing the linch-pin *a*, when the wheel is to be taken off; but if the linch-pin *a* should accidentally get out, this additional pin *b* would effectually keep the wheel on, as its hanging position does not at all tend to shut the pin up into the axle, but the contrary. The common linch-pin *a* is put in downwards, that its weight may always tend to keep it in, and is secured in the usual way by a strap, the holes for which may be seen in the figures.

ON MANUFACTURING PYROLIGNEOUS ACID.

Acetate of Iron—or Iron Liquor, and Acetate of Alumine.

THE extensive use of these preparations by Dyers, and Calico printers, renders the knowledge of the mode of making Pyroligneous acid, of great importance; for this reason the following information is given. It is collected from various sources, but chiefly from the *Commercial Magazine of London.*

THE name Pyroligneous has been given, because it was distilled from wood; it had been long known that the hardest woods afforded an acid principle mixed with an oil, which partly disguised its properties. But no one had directly attended to a determination of the habitudes of this acid, until Mr. Goettling published his researches on the acid of wood, and the ether it affords. The following is the most common method practised to obtain it.

Having a large cast iron cylinder, one end of which can be opened to admit wood, and formed to shut so as to exclude the air. The cylinder is placed in such a manner, that the fire is under it to heat it as much as possible. Oak, in pieces about a foot in length, is put into the cylinder, which is filled as full as possible, without being wedged, and the door shut close to exclude air; from the cylinder is a worm that runs through cold water to condense the acid, by this it is conveyed to a large cask placed on one end, where there is a pipe to carry the acid from that to two or three more; thus the acid is completely secured from flying off in the vaporous state; the fire is raised to a great heat, sufficiently powerful to convert the wood completely into charcoal (coke.) When the acid is done coming over, the fire is taken out, and the mass is left to cool in the confined state, when it becomes perfect charcoal. In the first cask tar is chiefly contained with the acid, it precipitates to the bottom, and is drawn off by a cock; it is afterwards boiled in an iron boiler to evaporate the acid before it is fit for use; if the acid is not strong enough, it is put into large square vats about

six inches deep, for the purpose of making a large surface, to evaporate a part of the water contained in the acid more speedily by a slow heat. These vats are bedded on sand upon the top of a brick stove, where a gentle heat is applied; thus it may be got in a pretty strong state. This acid is used instead of acetate of lead (sugar of lead) by the calico printers, to make their acetate of iron or iron liquor; though it is not sufficiently pure, it does well enough for blacks, browns, drabs, &c. but for yellows or reds it is not so good, owing to the oil and tar which are in combination with it. However, some have attempted to depurate (purify it) and have in part succeeded, and I have no doubt but in time it will answer *all* the purposes of acetate of lead. It tastes of acetous acid mixed with oil, and smells a little of tar, in the same manner as the smoke of wood when burning does. In fact, it is merely acetous acid holding an empyreumatic oil in solution. In order to obtain this acid, Mr. De Morveau distilled small pieces of very dry beech wood in an iron retort, by a reverberatory furnace; he changed the receiver when the oil began to rise, and rectified the product by a second distillation. Fifty ounces of very dry chips, afforded 17oz. of rectified acid of an amber colour, not at all empyreumatic, whose specific gravity compared with that of distilled water, was 49 to 48.

To cleanse the Pyroligneous acid, the following plan has been proposed.

"I would propose that the filter should be made of wood, of a pyramidal form, well seasoned, and well put together. The inside should be stuck full of small wooden pegs, and then overlaid with a coating of calcined gypsum and sand, of about an inch thick; or of fresh burnt quarry lime and sand, brought to the proper consistence with water, and immediately after covered with pounded glass, of the fineness of sea sand, by sifting it through a wire sieve.—Sand may answer the purpose well enough; but if it cannot be got, broken green glass will furnish an adequate substitute. The pegs are intended to secure the adherence of the lining, which should completely cover them. In this manner an artificial stone or glass funnel of any requisite size may be easily supplied,

through which the liquor may be strained without the hazard of receiving, or of being injured by any foreign metallic impregnation, to guard against which more effectually, the joinings should be all dove-tailed, and wooden pegs used instead of nails, wherever these are necessary. Let the bottom opening be closed with a piece of strong hair cloth, or coarse canvas to support a layer of flint, broken into pieces of the size of a walnut; this to be followed with two or three more layers of the same material, or of green grass, progressively smaller in size; the surface being made level, and the interstices filled up with a layer about the size of hempseed, sifted over it through a tin riddle. Cover this with fresh burnt charcoal, (the residum of the article from which the acid is distilled), to the thickness of three or four inches, which should not be smaller than peas, and this may be again covered with a layer of an inch thick as fine as sand, which may be occasionally removed as it becomes clogged with the impurities of the liquor filtering through it. It is obvious that the charcoal must be secured from floating, by a covering of sufficient weight of broken or flint glass.

A cask, or large box, having its bottom bored full of holes, may be used instead of this trough funnel, being lined in the same manner."

Iron liquor, or acetate of iron, was formerly made of vinegar and old iron; at present it is formed by the pyroligneous acid and copperas. To obtain this, as much chalk is thrown into the above mixture, as will destroy the acidity. The rationale is as follows:

The chalk saturates the pyroligneous acid; the sulphuric acid then unites with the lime, while the pyroligneous acid in consequence of double affinity, combines with the iron, forming the iron liquor, which remains in solution, and is taken for use.

In preparing acetate of alumine, acetate of lead and alum are employed, and the same process pursued as for iron liquor.

FERTILITY OF AMERICAN GENIUS.

By a report made to the House of Representatives, by the Secretary of state, in January last, it appears, that from the passage of the law for the protection of the rights of inventors, discoverers and authors, to the 1st of May 1805, five hundred and ninety-six patents had been issued. From that date to the 28th December 1810, eight hundred and two patents were taken out. The Editor intends to make an arrangement, in order to enable him to publish in the ensuing numbers of this work, a regular statement of the patents which have been granted during the preceding quarter; and he offers the "Archives" to the ingenious, as a proper channel to announce and describe their inventions and discoveries.

The following publication of Mr. Thornton, will prove highly serviceable to those persons who intend to apply for patents from the general government.

(From the National Intelligencer.)

TO THE CITIZENS OF THE U. STATES.

Patent Office, March 5th, 1811.

HAVING the honour of directing or superintending the important duties of issuing patents for arts and inventions, which formerly were thought worthy of the labours of a council, composed of the secretary of state, the secretary of war, and the attorney general of the United States, I have thought it a duty to my fellow citizens to publish a few lines of information to facilitate the mode of acquiring patents, by which many will be enabled to dispense with long journies to the seat of government, or with troubling their friends by a tedious correspondence.

Before an application be made for a patent I would advise the inventor to examine well the dictionaries of the arts, and sciencies, the Repertory of Arts and other publications that treat of the mechanic arts, to endeavour to ascertain if the invention be new; also to make inquiry of scientific characters whether or not the invention or discovery be practicable. These previous inquiries will sometimes prevent great trouble, and save the expense of much time, labour, and money; for a patent does not

confer rights, where just claims do not exist; and as there is at present no discretionary power to refuse a patent, even where no just claim exists, it may be proper to caution the purchaser of patent rights against the supposition that the invention patented is always valuable, or new, or that it interferes with no previous patent. The respectable names of the president, the secretary of state, and attorney general are requisite to give validity to a patent; but ought never to be considered in any degree as evidence of the originality or utility of invention. The issuing of patents is grounded not only on a desire to promote the progress of useful arts, but also to prevent the loss of valuable secrets; for many have been buried with the inventors previous to the organization of this system of protection for the property of talent, mind, and genius. Formerly the arcana of any profession were withheld from the tyro; his initiation was gradual and secret, and the caution with which inventors worked to prevent the infringement of unprotected rights, confined many important inventions to limits too narrow to materially benefit either the inventors or the world: at present the law grants a monopoly to the inventor, for a limited time, provided the art, invention, discovery or machine, be duly explained, deposited, and recorded, for the benefit of mankind as soon as the time limited has expired—and the patent is not only an evidence that the inventor has formally confided his secret to the public, but some declaration of the protection of the right from infringement; nevertheless, of the right, by others, a jury of the country is only competent to decide.

The general law concerning the issuing of patents will be found in the 2d vol. of the Laws of the United States, page 200. This law provides for citizens only; but a subsequent law, vol. 5th, page 88, provides also for applicants who have resided two years or upwards in the United States, and who are not citizens.

In applying for a patent it is necessary to attend to every legal form, for in consequence of inattention to* forms only, some of the patents issuing formerly, have in the course of law been declared null and void.

* Oliver Evan's, among the number.

MODE OF APPLICATION

* "Every inventor before he presents his petition to the secretary of state, signifying his desire of obtaining a patent, shall pay into the treasury of the United States, † thirty dollars, for which he will be furnished with duplicate receipts; one of which he shall deliver to the secretary of state when he presents his petition: and the money thus paid, shall be in full, for the sundry services, to be performed in the office of the secretary of state, consequent to such petition. This petition must be addressed to the secretary of state, and may be in the following or in a similar style,

TO THE HON. ROBERT SMITH,‡ SECRETARY OF STATE OF THE UNITED STATES.

The petition of A. B.—of———in the county of——and state of——respectfully represents— That your petitioner has invented a new and useful improvement "[‖ or art, machine, manufacture or composition of matter, or any new and useful improvement in any art, machine, manufacture, or composition of matter] in————————not known or used before his application," the advantages of which he is desirous of securing to himself and his legal representatives: he therefore prays that letters patent of the United States may be issued, granting unto your petitioner his heirs, administrators or assigns, the full and exclusive right of making, constructing, using, and vending to others to be used, his said improvement, [art, invention, machine, manufacture or composition of matter, &c.] agreeably to the acts of congress in such case made and provided; your petitioner having paid thirty dollars into the treasury of the United States, and complied with the other provisions of the said acts.

A. B.

[Date.]

* See laws of the United States, vol. 2d, chap. XII. § 11, p. 205.

† Notes on any of the banks of the United States.

‡ James Munroe is now secretary of state—Editor.

‖ 1st § of the above, p. 200.

The *specification* or description of the machine, art, discovery or invention, must be given in clear and specific terms, designating it from all other inventions, and describing the whole in such a manner as to comprehend not only the form and construction, (if a machine) but also the mode of using the same; and if it be only an improvement on a certain machine already invented by the applicant, or any other, it ought to be so mentioned or described: and as this specification, description, or schedule enters into and forms part of the patent, it must be without any references to a model or drawing, and must be signed by the applicant or applicants before two witnesses. It is material that this be in good language, and correctly written, as it is transcribed into the patent, and the original papers will be deposited in an office that will hand them down to posterity, by which the honour of the country is concerned in this attention. The modest inventor will no doubt exclude those panegyrics on the excellence of his invention or discovery, which abound sometimes in the productions of the inferior genius, but which ought not to enter into the patent.

The following or a similar oath or affimation taken, (before a judge of any of the courts, or a justice of the peace, or any person qualified to administer an oath) by the applicant or applicants, must be subjoined to the specification, if citizens of the United States.

FORM.

County of——} ss.
State of ——}

On this———of———181———before the subscriber, a justice of the peace, in and for the county aforesaid, personally appeared before the above named A. B. and made solemn oath (or affirmation) according to law that he verily believes himself to be the true and original inventor or discoverer of the art [machine, invention or improvement, composition of matter, &c.] above specified and described for———————————————— (mention here the object or intention)———and that he is a citizen of the United States. J. P.

If not a citizen (or citizens) the following addition must be made to the declaration, that he verily believes himself to be the true and original inventor or discoverer of the art, &c.

* And that the same hath not, to the best of their knowledge or belief been known or used either in this or any foreign country.———" Also that he (or she) hath resided in the United States two years and upwards. J. P.

The specification must be accompanied by a good drawing, in perspective, of the whole machine or apparatus—" † where the nature of the case admits of drawings; or with specimens of the ingredients, and of the composition of matter, sufficient in quantity, for the purpose of experiment, where the invention is of a composition of matter." "And such inventor shall, moreover, deliver a model of his machine, provided the secretary shall deem such model to be necessary." It is requisite, in giving a drawing of the machine, to give also rational drawings of the interior, when the machine is complex; and every drawing should be accompanied by explanatory references. When a machine is complex, a model will likewise be necessary, not only to explain and render it comprehensible to a common capacity, but also to prevent infringements of rights; for many will plead ignorance of drawings, who cannot avoid the conviction of wheels and pinions.

The drawings ought not to exceed a quarto size, and if confined to octavo they would be still better, where it can be done conveniently and distinctly.

Many of the drawings in this office are executed in a very handsome style, and do much credit to the talents of the gentlemen whose names are ascertained. If the artists would always sign them, information might be given to the applicants for patents where to apply for drawings.

* Laws of the United States, Vol. v. ch. xxv. p. 89

† Ibid. Vol. ii. ch. xii. p. 202.

Among the best I have received, I notice the names of

Messrs. JAMES AKIN, *Philadelphia.*
JACOB CIST, P. M. *Wilkesbarre, Penn.*
FRANCIS GUY, *Baltimore.*
GEORGE HADFIELD.
NICHOLAS KING, *City of Washington.*
——————— PECKMAN, *Roxbury, Massa.*
JOHN R. PENNIMAN, *Boston.*
ARCHIBALD ROBERTSON, 78 Liberty st. *N. Y.*
——————— STEWART, *Hartford, Con.*
JOHN STICKNEY, *Baltimore.*
——— STILES, *Worcester, Mas.*
WILLIAM STICKFORD, *Philadelphia.*
JAMES WATSON, *Utica, Oneida Co. New York.*

Many being without the names of artists, I cannot do all the justice I wish.

The papers must all be sent under cover to the secretary of state, which of course renders them free of postage: but if models be sent, their freight or carriage hither must be paid; and before packing them, the name or names of the inventor or inventors should be written thereon, with the name of the machine, and the date:—for sometimes on receiving them it is difficult to know to whom they appertain.

The congress, being impressed with a high sense of the value of the inventions of our citizens, have purchased an elegant and extensive building, wherein preparations are now making for the accommodation of a very numerous collection of machines illustrative of the ingenuity displayed; and this museum of the arts it is presumed, will stimulate the ingenious to send the models of their machines and inventions in a style that will rather honour than discredit the country.

Copy-rights of books, prints, charts, maps, &c. are secured by* depositing before publication, a printed copy of the title of such

* See an act for the encouragement of learning, &c.—laws of the United States, Vol. 1. ch. xv, § 3. p. 121.

map, chart, book, or books, in the clerk's office of the district court, where the author or proprietor shall reside, who will record the same; and the author or proprietor shall within two months from the date of the record, cause a copy of the said record, to be published in one or more of the news-papers printed in the United States, for the space of four weeks. *And within six months after publishing the map, chart, book, or books, the author or proprietor shall deliver or cause to be delivered to the secretary of state, a copy of the same; and when deposited and entered into the patent office, a certificate will be returned of its being received.† This will secure the sole right of publication for fourteen years to the author or proprietor, if a citizen of the United States, or resident—"and if at the expiration of the said term, the author or authors, or proprietors, any of them be living, and a citizen or citizens of these United States, or resident therein, the same exclusive right shall be continued to him or them, his or their executors, administrators or assigns for the further term of fourteen years: *Provided* he or they shall cause the title thereof to be a second time recorded, and published in the above manner, within six months before the term of fourteen years aforesaid.

WILLIAM THORNTON.

* Ibid. Sect. 4. p. 122.
† Ibid. Sect. 1. p. 118, 119.

ERRATA.

Page 64, line 17, erase "*crooked and.*"
68, 5, "for produce," read *produces.*
78, 3d line from bottom, after "powder," add *for every* 20 *head.*
88, 13, for "as far back as the tail," read *the back as far as the tail.*
91, 6, for 155, read 145.
93, *note*, for was read *were.*
109, line 2, in some copies, for "which was," read, *which were.*
115, 3d line from bottom, for "less," read *shorter.*
123, line 21, for "that," read *from.*
219, 6 lines from bottom, erase, "sir,"
last line, for Deliches Soyæ, read *Dolichos Soja.*
241, *note*, for "12000," read 1200.
280, 11th line from bottom, after "cover," add, *leaving.*
317, the last line of p. 317, and the two first paragraphs of p. 318, belong to the bottom of p. 308.
337, line 22, for "pened," read opened.

INDEX.

A

B

C